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MANUAL

OF

CONCHOLOGY;

STRUCTURAL AND SYSTEMATIC.

WITH ILLUSTRATIONS OF THE SPECIES.

BY GEORGE W. TRYON, JR.

CONTINUATION BY

HENRY A. PILSBRY,

CONSERVATOR OF THE CONCHOLOGICAL SECTION OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA.

Vol. XV.

POLYPLACOPHORA,

(*Chitons.*)

ACANTHOCHITIDÆ, CRYPTOPLACIDÆ AND APPENDIX.

TECTIBRANCHIATA.

PHILADELPHIA:

Published by Conchological Section,

ACADEMY OF NATURAL SCIENCES,

OF PHILADELPHIA.

1893.

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PREFACE.

In this volume are contained monographs of two families of POLYPLACOPHORA: *Acanthochitidæ* and *Cryptoplacidæ*, with an Appendix, and an Index to the entire group. The APLACOPHORA are then described; and the remainder of the volume is devoted to the various groups of spiral shelled TECTIBRANCHIATA.

As it is not proposed to include the NUDIBRANCHIATA in the MANUAL, the present volume will complete the First Series, as orginally projected by its illustrious founder.

The Conchological Section of the Academy of Natural Sciences contemplates the commencement of a *Third Series* of the Manual of Conchology, to include the *Marine bivalve Mollusks*. The continued support of the subscribers to the First Series is earnestly desired, for without their liberal aid this great enterprise cannot be undertaken.

E. J. NOLAN, M. D.,
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MANUAL OF CONCHOLOGY.

MONOGRAPH OF THE POLYPLACOPHORA.

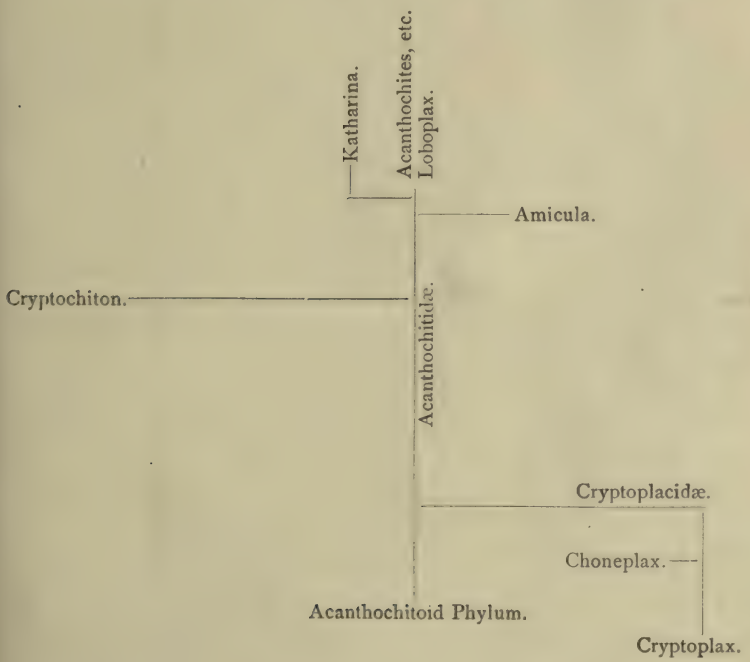
(CONCLUDED.)

Acanthochitoid Phylum.

The systematic position and genesis of this stock of chitons has been indicated on pages xxiv and xxvii of the preceding volume of this work. Two families, *Acanthochitidæ* and *Cryptoplacidæ*, are recognized, both containing some peculiarly modified forms.

The following diagram expresses the approximate relationships and phylogeny of the genera. It must be remembered that those genera which have undergone the greatest modification are in this phylum distinctly degenerate in character, and represented by but few species of restricted range.

The reverse is true of the most modified genera of *Chitonidæ*.



Family ACANTHOCHITIDÆ Pilsbry.

Chitons in which the valves are more or less immersed in the smooth or hairy (never scaly) girdle; the tegmentum or outer layer therefore being much smaller than the articulamentum or inner layer, and having the exposed surface (when present) divided into *dorsal* (or jugal) and *latero-pleural* areas, the latter formed by the union of the lateral areas with the sides of the central areas. Insertion teeth sharp, nearly smooth. Body not vermiform. Posterior valve either slit similarly to the head-valve or having a posterior median sinus; the mucro submedian.

Besides the positive and negative characters given above, the species of this family generally have 5 slits in the head-valve, and median or short gills.

It is difficult to quote synonymy for the family name, as genera grouped here by me are scattered throughout the two grand divisions of the Carpenterian arrangement, being included in the *Ischnoidea, Acanthoidea, Mopaloidea* and *Cryptoidea* of his classification.

The descent of this family from the primitive *Ischnochitonidæ* can safely be affirmed, although no existing genus affords a clue to the exact branch of that family which gave rise to this peculiar series. The general prevalence of a short gill-row, the simplicity of the insertion-plates and teeth, and the low development of sense-organs in the shell, all indicate an ancestral stock not far removed above the *Lepidopleuridæ* except in the development of slits and teeth.

The genera of *Acanthochitinæ* are closely linked together by intermediate forms, although the superficial modification is considerable. The more normal forms (*Leptoplax, Spongiochiton*) have the tail valve many-slit, like the head valve, and perfectly "regular" in form; these lead to forms with the posterior teeth uneven and vertical (*Loboplax, Notoplax, Katharina*), and then to those in which the posterior teeth are obsolete and lost, their place being excavated into a tail-sinus (*Acanthochites*). So far, the course of development has been parallel to that followed by the *Mopaliidæ*; but the progressive envelopment of the valves by the girdle, brings another factor into play at this point: viz., the backward growth of the posterior covered margins of the valves. This tendency is very clearly seen in the more covered species of *Acanthochites*, etc., but it becomes much more pronounced in such forms as *Cryptoconchus* and *Amicula;* and in *Cryptochiton* the development of posterior lobes, as well as the burying of the valves themselves, reaches its culmination.

The *Chitonellidæ* betray unquestionable proofs of descent from a stock distinctly *Acanthochitoid* in its organization; but their special characters render it useful to treat that group as a separate, though closely allied, family.

See Vol. XIV, p. xxxii, paragraph *bb* for synopsis of genera.

Subfamily ACANTHOCHITINÆ.

Genus SPONGIOCHITON Carpenter.

See Vol. XIV, p. 26. This is probably a valid genus, allied to *Acanthochites* but distinguished by the anterior dilation of the girdle and the more regular slitting of the tail valve.

Genus (?) LEPTOPLAX Carpenter.

See Vol. XIV, page 25, where this genus was erroneously included in the *Ischnochitoninæ*. Specimens should be critically examined now that it is placed next to *Acanthochites*, for it may prove to be a subgenus or section of the latter, near *Notoplax*.

Genus ACANTHOCHITES Risso, 1826.

Acanthochites, *Acanthochætes* and *Acanthochiton* of authors,+ *Phakellopleura* Guild. (*haud* Shuttlw.!),+*Phacellopleura*, *Macandrellus* and *Stectoplax* of Carpenter,+*Notoplax* Ad.,+*Cryptoconchus* (Blainv.) Guild.

Valves partially buried in or covered by the girdle, the exposed part consisting of a smooth or striated dorsal band, and granulated side-areas, the latter sometimes lacking. Anterior valve with 5 symmetrically placed slits; median valves with 1 slit on each side; posterior valve with two or several slits. Girdle varying from densely hairy to naked, but always having four bristle-bearing pores around the head valve, and a single series of pores on each side placed at the sutures. Gills short, extending forward from one-third to three-fourths the length of the foot.

This genus is distinguished from *Leptoplax*, *Spongiochiton* and *Katharina* by the presence of bristle-bearing pores at the sutures, and from the first two moreover by the less regular slitting of the posterior valve. The genus *Katharina* differs from *Acanthochites* further in the more numerous, unsymmetrical anterior slits, and in the gill-row, which is as long as the foot.

Acanthochites is the only genus (of more than one species) in which

the girdle-pores seem to be a constant generic character; and even in this genus some species have them very small, or even subobsolete (*A. floridanus*). The pores are normally 18 in number, but rarely one or two additional pores are developed behind the posterior valve.

A number of sections have been proposed, based on the degree of covering of the valves, and the denticulation of the posterior valve. Part of them have been ranked as genera by authors, but the more I see of the species, the less rank I am disposed to accord these minor groups. Their differential characters are trivial, and intermediate forms may be expected to occur between any of them.

Synopsis of sections,

A. Anterior valve without radiating ribs; not obviously lobed around the lower edge of tegmentum.

b. Tail valve with one slit on each side, and a wide, shallow sinus between; girdle covered with spicules and having well developed tufts, *Acanthochites*.

bb. Tail valve with several slits behind; girdle encroaching at sutures on the valves. *Notoplax*.

bbb. Tail valve with several slits; girdle naked, leathery, covering the valves except for a linear band at the ridge; tufts small, the pores sometimes raised on tubercles, sometimes subobsolete, hardly visible, *Cryptoconchus*.

AA. Anterior valve having 5 radiating ribs, its lower margin 5-lobed; tail valve multifissate; girdle nearly naked, having small pore tufts, *Loboplax*.

Section *Acanthochites* Risso, 1826.

Acanthochites Risso (as of Leach *ms.*), Hist. Nat. de l'Eur. Mérid., iv, p. 268 (first species *A. communis*,=? *A. discrepans;* second species *A. carinatus*=*A. fascicularis* L.).—Gray, P. Z. S. 1847, pp. 66, 69.—*Acanthochetes* Leach (*MS.* 1819) in Gray, P. Z. S. 1847, p. 169; Guide, p. 186.—Sowb., Conch. Man., edit. 2, p. 57 (1842).—*Acanthochiton* Herrmannsen, Indicis Generum Malacozoorum Primordia, i, p. 2 (vid. ibid., "*Acanthochitus*").—*Acanthochiton* of Carpenter and many modern authors.—*Acanthochistes* Costa, Faun. Reg. Nap., p. 2.—*Phakellopleura* Guilding, Zool. Journ. v,

p. 28 (1829); type *Ch. fascicularis* Sow. Gen., f. 3.—*Stectoplax* Cpr. in Dall, Proc. U. S. Nat. Mus. 1881, pp. 284, 288, 289, 291 (1882); type *S. porrecta* Cpr.

Valves partly covered, *the anterior lacking radiating ribs; the posterior valve having the insertion-plate with a single slit on each postero-lateral edge, and a wide, toothless sinus in the middle behind.* Girdle with large, dense tufts of glistening spicules. Type, *C. fascicularis* L.

In this, the typical section, the tail valve has been further differentiated from the primitive type than in the other sections. The hairs of the girdle, and especially the tufts, are more exuberantly developed than in any other group of *Chitons.* The valves vary greatly in the degree to which they are buried in the girdle. The species are numerous, but owing to the similarity of the sculpture they are very hard to distinguish, even when well described.

(1) *Species of European and African Seas.*

A. fasciculatis Linné. Pl. 4, figs. 77, 78, 79.

Shell elongated, moderately convex, more or less distinctly carinated. Surface dull, varying much in color, "brown, chocolate, orange, yellow, pinkish or red, now and then mottled or streaked with white, pale green or brown."

Median valves broadly subtriangular (seen detached), the beak slightly projecting, latero-anterior outline of tegmentum convex. Latero-pleural areas covered with flat or *concave granules, which are ovate-oblong or drop-shaped and rather remote.* Dorsal areas triangular, not abruptly defined at the edges, rather flattened and longitudinally obsoletely striated. Anterior valve granulated, the lower edge of the tegmentum slightly and obsoletely angular. Posterior valve with *subcentral elevated mucro.*

Interior greenish, often roseate along the cavity. Insertion-plate of posterior valve having between the two slits a small posterior wave or sinus with a slight lobe on each side.

Girdle moderately broad, more or less closely covered with short spicules which are usually tawny or grayish; and a thick tuft of greenish or whitish bristles at each suture, four such tufts around the head valve. Periphery of girdle fringed with spines longer than those covering the rest of the girdle, but shorter than those of the tufts.

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Length 25, breadth 11, mill.; divergence 110.°

Length 15, breadth 7 mill.

Finmark and Great Britain, south to Mogador; off the Strait of Gibraltar, (and perhaps the Canaries); Mediterranean and Adriatic Seas. On rocks, stones and oyster shells from low tide to 25 fms.

Chiton fascicularis Linn., Syst. Nat. xii, p. 1106 (1766), and of many authors, including Lam., Payraudeau, Philippi, Weinkauff, Forbes & Hanley, Hist. Brit. Moll., t. 59, f. 5.—Jeffreys, Brit. Conch. iii, p. 211; v, p. 197, t. 55, f. 3; Ann. Mag. Nat. Hist. 1870, p. 10; P. Z. S. 1882, p. 666, Woodward, Man. of Moll., t. 11, f. 30.—Sowb., Conch. Illustr., f. 87, 87a.—Audouin, Ex. Pl. Savigny, p. 127; Savigny, pl. 3, f. 5.—*Acanthochites fascicularis* Sars, Moll. Reg. Arct. Norv., p. 117.—*Anisochiton* (*Acanthochiton*) *fascicularis* Fischer, Manuel de Conchyl., p. 881, f. 623 (bad).—*Anisochiton* (*Acanthochites*) *fascicularis* Buq., Dautz. and Dollf., Moll. Rouss. i, p. 502, t. 61, f. 17–20; t. 62, f. 6.—*Acanthochites carinatus* Risso, Hist. Nat. Eur. Mérid, iv, p. 269 (1826).—*Acanthochætes vulgaris* Leach, Synops. Moll. Gt. Brit., p. 229 (1852).—*Chiton crinitus* Pennant, Brit. Zool. iv, p. 71, t. 36, f. 1, A1 (1777); edition of 1812, vol. iv, p. 142.—Reeve, Conch. Icon., t. 26, f. 176. Not *Ch. crinitus* Sowb.—? *Chiton globulosus* Chiereghini *MS.*, Brusina's Ipsa Chier. Conch., p. 43, 1870.

This species is smaller than *A. discrepans* and the valves are much more coarsely granulated, the granules being ovate, at least toward the beaks. The median smooth area is wider than in *discrepans*, and less raised; the tufts are larger, and the girdle is fringed at the margin.

Var. *attenuata* Jeffr. Much longer and narrower in proportion to the breadth. England.

A. æneus (Risso) Monts.

This Chiton resembles the other species of the group, but is more arched, reddish or bright colored, having distinct granules, and with the hairs of the tufts copper colored; border thick and spinous. This beautiful species belongs to the laminarian zone, and has occurred at various points in the Mediterranean. The *A. fascicularis* is littoral, smaller, black with the keel chalky white; and moreover its granulations are less numerous and more prominent. *A. discrepans* Brown is also littoral, is larger and better known. Its coloration is ordinarily greenish, its granules minute and numerous; the hair-tufts are a beautiful silvery green. (*Monts.*)

Back subcarinated, blackish; margin wide, tuberculate; tufts white, bronzed. The back is oblong, blackish, bordered by a wide tuberculous band ornamented with bunches of white or bronze hairs. Length 15 mill. Animal light red; head rounded, gills reddish, etc. (*Risso.*)

Balearic Is. (Hidalgo); *Nizza* (Risso); *Genoa* (Issel); *Gorgona* (Caifassi); *Naples; Palermo* (Monts.)

Acanthochites æneus Risso, Hist. Nat. de l'Eur. Mérid. iv, p. 269 (1826).—Carus, Prodromus Faunæ Mediterraneæ ii, pt. 1, p. 182 (1889).—*Chiton* (*Acanthochites*) *æneus* Monterosato, Journ. de Conchyl. 1878, p. 147.—*Chiton gracilis* Jeffr., Ann. Mag. N. Hist. (3), iii, p. 106, t. 3, f. 9*a*, *b* (1859).—Sowb., Illustr. Index Brit. Sh., t. 10, f. 6.—*C. fascicularis* var. *gracilis* Jeffr., Brit. Conch. iii, p. 212.

With this form Monterosato identifies *C. gracilis* Jeffreys, the description which follows:

" *C. fascicularis* var. *gracilis* Jeffr. Pl. 4, fig. 83.

Longer than usual, with finer sculpture; girdle broader and membranous, sparsely set with spines and mostly having an extra tuft (occasionally two) at the tail.

Weymouth and off Milford Haven. Dredged in deep water.

Differs from *A. fascicularis* in being slender, the girdle more sparsely pilose, and having one or two tufts behind the posterior valve, 19 or 20 tufts in all. The granulation of valves is finer than in *fascicularis*, coarser than in *discrepans*. As I have seen no Mediterranean specimens I cannot affirm their identity with those of the south of England; but they are probably the same. The Mediterranean form has not been figured. Jeffreys in his later writings considered this a delicate deep-water form of *fascicularis*, a conclusion with which I am disposed to coincide. Further study with abundant material from the Mediterranean and Atlantic is necessary to establish the true status of the form.

The form described by Rochebrune as *A. hamatus* is probably a synonym of *A. æneus*. The original description follows:

Acanthochites hamatus Rochebr. Shell elongated, ovate, roseate, intensely carinated, the carina very high, linear, rugulose, posteriorly acute. Anterior valve rounded, intermediate valves with the lateral areas intensely granulated all over, the grains polygonal, flattened, subumbilicated. Marginal ligament pale rufous, with 9 shining

whitish bunches. Length 17, breadth 8 mill. Oran, Algeria, collected by Deshayes' expedition of 1842; types in the Paris Museum. (*Rochebr.* in Bull. Soc. Philomath. 1881–1882, p. 191.)

A. DISCREPANS Brown. Pl. 4, figs. 80, 81, 82.

Shell oblong, rather elevated, carinated. Color grayish, variously mottled with dull reddish-brown; the ridge often marked with lilac or blackish.

Median valves, when detached, showing a broadly triangular tegmentum, slightly beaked in the middle of the subconcave posterior margin, the latero-anterior margin sigmoid, convex at the outer, concave or subconcave toward the anterior termination; length of tegmentum contained $1\frac{2}{3}$ times in its breadth, except the 2nd valve, which is longer. *Latero-pleural areas sculptured with very fine and numerous round flat-topped granules,* arranged in curving slightly irregular series, radiating from the beaks. Dorsal area narrowly triangular, elevated at the edges, somewhat convex, finely striated longitudinally. Anterior valve granulated, its lower margin feebly scalloped. Posterior valve with *central,* slightly projecting mucro; *the tegmentum oval, wider than long.*

Interior white, faintly tinged with blue, and more or less suffused with lilac-pink along the middle of the cavity. Sinus rather deep angular. *Posterior valve having no posterior sinus or wave in the insertion-plate,* which has the usual single slit on each side, sometime, doubled on one side.

Girdle broad, grayish, covered with a thick velvety pile, and having tufts of white, yellowish or greenish spicules at each suture, with four additional around the anterior valve; *periphery of girdle not furnished with a fringe of spicules longer than those covering the surface.*

Length 36, breadth 19 mill.; divergence 105°–115°.

Channel Islands to Morocco and Madeira; Mediterranean and Adriatic Seas. Low water to 25 fms., on stones.

Chiton discrepans BROWN, Ill. Conch. Gt. Brit., p. 65, t. 21, f. 20 (1827).—FORBES & HANLEY, Hist. Brit. Moll. ii, p. 396, t. 58, f. 4. —SOWB., Illustr. Index Brit. Sh., t. 10, f. 7.—JEFFREYS, Brit. Conch. iii, p. 214; v, p. 198, t. 55, f. 4; P. Z. S. 1882, p. 667.—WEINKAUFF, Conchyl. Mittelm ii, p. 413.—*Chiton fascicularis* var. *major* PHIL., Enum. Moll. Sicil. i, p. 108, t. 7, f. 2; ii, p. 83.—*C. fascicularis* (part) DESH., in Lam., An. s. Vert. (2), vii, p. 492, and of POT. & MICH., REEVE, Conch. Icon., t. 10, f. 53, PETIT, Journ.

de Conch. 1852, p. 71, Weinkauff, *l. c.*, 1862, p. 333, *et al.*—*Chiton crinitus* Sowb., Conch. Illustr., p. 2, f. 88, 88a, 93.—Thorpe, Brit. Mar. Conch., p. 251, 1844; not of Pennant.—*Anisochiton discrepans* Buq. Dautz. & Dollf., Moll. Rouss. i, p. 505, t. 61, f. 21–25; t. 62, f. 7.—? *Acanthochites communis* Risso, Hist. Nat. de l'Eur. Mérid., iv, p. 269.

Smith (P. Z. S. 1891, p. 392) reports this species from Aden, and remarks that he cannot separate *C. scutiger* Ad. & Rv., Corean Archipelago, and *C. carinatus* A. Ad. & Ang. from Port Jackson, from this species.

A. discrepans is readily distinguished from *A. fascicularis* by its larger size, the much smaller, more numerous and round instead of oval granules; the less conspicuous tufts, etc.

A. adansoni Rochebrune. Pl. 8, figs. 33, 34.

Shell elongated, whitish-violaceous, with black and green spots; anterior valve semilunar; posterior valve small; intermediate valves triangular, nearly concealed, closely and very minutely squamulose; anterior areas of valves narrow, very smooth and longitudinally striolate; marginal ligament wide, pilose, hairs coarctate, generally reddish, and with 9 bunches of glossy, roseate, slightly yellowish bristles.

Length 20, breadth 8 mill. (*Rochebr.*)

Strait of Santiago; Saint Vincent, Cape Verde Archipelago; Goree and Dakar, West Africa.

Acanthochites adansoni Rochebr., Journ. de Conchyl. (3) xxi, p. 44 (1881); Bull. Soc. Philomath. de Paris, 1880–'81, p. 116; Nouv. Arch. du Mus. (2), iv, p. 238, t. 17, f. 9*a*, *b*.—*Kalison* Adanson, Voy. au Sénégal, pt. 2, p. 42, t. 2, f. 11 (young individual, *teste* Rochebr.)

The posterior valve is excessively narrow, rounded, almost entirely covered by the girdle; median valves triangular, carinated, the carina obtuse, covered with ovoid scales regularly arranged in radiating lines; middle of the valves narrow, very finely striated longitudinally. (*Rochebr.*)

The notes given under *A. bouvieri* on Rochebrune's figures of that species, apply also to this. They are false in most particulars.

A. bouvieri Rochebrune. Pl. 3, figs. 65, 66.

Shell elliptical, carinated, black. Anterior valve elongated; posterior valve rounded; median valves triangular, wide, beaked, covered with minute points; anterior area very narrow, transversely

most minutely radiate. Marginal ligament wide, black or brownish, having 9 dense, elongated bunches, whitish or reddish.

Length 15, breadth 9 mill. (*Rochebr.*)

Strait of Saint Lucie; Santiago, Cape Verde Archipelago.

A. bouvieri Rochebr., Journ. de Conchyl. 1881, p. 45; Bull. Soc. Philom. 1880–'81, p. 117; Nouv. Arch. du Mus. (2) iv, p. 239, t. 17, f. 10*a*, *b*.

The front valve is triangular, the posterior valve quite wide, rounded. It occurs also at Dakar and Goree, on the mainland of Africa, living with *A. adansoni*.

The artist who drew Rochebrune's figures omitted the slits in the insertion-plates; he supplied several extra girdle-tufts; and finally, he represented only seven valves, and these are very incorrect at the sutures. To what extent the figures may be otherwise faulty I cannot tell, but I have very grave doubts about the correctness of the sculpture of the dorsal areas represented in the detail figure.

A. garnoti Blainville. Pl. 14, figs. 11–16.

Shell elongated, rather depressed, not carinated. *Brownish, with two slightly diverging whitish stripes bounding the dorsal area.*

The median valves are rather beaked when not eroded. The tegmentum varies on different valves from subpentagonal to subquadrangular. Latero-pleural areas closely and evenly covered with elongated granules. Dorsal areas triangular, rather wide in front, *not sharply defined at the sides*, closely striated longitudinally, the striæ coarser at the sides, and becoming transformed into the granulation of the side areas. Posterior valve small, *the tegmentum broader than long*. Posterior sinus shallow, with a slight lobe and on each side a slit. Mucro behind the middle.

Interior a rather dark blue-green, the cavity and central callus of each valve purple-brown. Sinus wide and rounded; *sutural laminæ very large, well rounded at their anterior extremities*, about equal in area to the tegmentum, *side slits inconspicuous*, posterior.

Girdle "dirty-green, closely covered with clear or dark-green bristles, white at the periphery, and having 18 bunches of numerous radiating bristles, which are dirty-green, hyaline, very brittle and over 2 millim. in length."

Length 20, breadth 10 mill. (specimen.)

Length 1 inch, 6 lines, breadth 1 inch (Quoy & Gaim.)

Table Bay, Cape of Good Hope.

Chiton garnoti Blainv., Dict. Sc. Nat. xxxvi, p. 552 (1825).—Quoy & Gaimard, Voy. de l'Astrol. Zool. iii, p. 401, t. 73, f. 9–14.—Lam., An. s. Vert., vii, p. 517.—Krauss, Die Südafrik. Moll., p. 42.—? *Chiton danielli* Sowb., Conch. Illustr., p. 7, f. 48.

The valves are more or less encrusted or eroded in most adult adult specimens. The *Ch. danielli* of Sowerby, figured in the Conchological Illustrations, but never described, has been considered synonymous on account of its locality; but as Krauss has pointed out, the figure represents that species with an additional pair of well developed tufts behind the tail-valve. It may prove distinct; but as the figure was drawn from a badly eroded example and in other respects agrees well with *garnoti*, it may be left here for the present.

A. penicillatus differs from this species in both coloring and sculpture. v. Martens reports *garnoti* from Mauritius and Réunion (Mobius' Reise, p. 300.)

A. penicillatus Deshayes. Pl. 4, fig. 84; pl. 8, figs. 29, 30.

Shell elongated, moderately elevated, carinated, the side-slopes nearly straight. Surface lusterless, varying from uniform cream-white to heavily blotched and maculated with blackish.

Median valves slightly beaked. Dorsal areas not elevated at the edges, rather narrow, closely and finely longitudinally striated. Latero-pleural areas covered with rather coarse, flat or subconcave scale-like granules, varying from drop-shaped to angularly oblong in form, arranged in radiating rows, and less obviously in serie parallel to the outer-anterior contours of the tegmentum (fig. 81). *Posterior valve having the tegmentum small, round, and equal in length and breadth,* the mucro moderately elevated and *near the posterior margin.*

Interior white; sinus broad and angular. Slits of side insertion-plates posterior and small. Posterior valve having a slight upward wave behind, at each side of which there is a projection or angle; the plate straight or concave from this angle to the lateral angles. Slits as usual. Girdle covered with short pile, having a rather small bunch of white spicules at each suture, four bunches around the head valve, and a fringe of similar long glassy spicules at the periphery.

Length 22, breadth 11 mill.; divergence 110°.

Réunion (Desh.); *Mauritius* (V. Robillard.)

Chiton penicillatus Desh., Moll. Réunion, p. 41, t. 6, f. 8–10 (1863).—*Acanthochætes p.*, Martens in Beiträge zur Meeresfauna der

Insul Mauritius u. der Seychellen, (Möbius' Reise nach Mauritius), p. 300 (1880.)

This species may be readily known by the light ground-color, the proportions of the posterior valve, and the fringe of long peripheral spicules, when these are retained. The sculpture differs markedly from the Cape species, the pustules being notably elongated, of a narrowly drop-shaped contour, averaging one-fifth of a mill. in length.

(2) *Species of New Zealand and Australia.*

A. ZELANDICUS Quoy & Gaimard. Pl. 14, figs. 9, 10.

Shell elongated, moderately elevated, hardly carinated. Greenish or gray, or "yellowish dotted with brown, some valves with a black line at the summit."

The median valves are hardly beaked. Latero-pleural areas covered with closely crowded, ovate, flattened granules. Dorsal areas narrowly triangular, closely and finely striated longitudinally. Posterior valve having the tegmentum small, transversely oval, *decidedly wider than long.*

Interior dark blue-green, often stained with purple along the cavity. *Sinus very wide* and squarish. Posterior valve obtusely, biangular behind, the edge of the insertion-plate, between the slits, minutely and distinctly crenulated.

Girdle rather narrow (in the dried state), greenish, covered with very short spicules, and having a marginal fringe of longer spicules, and 18 tufts of light blue spicules.

Length 28, breadth 12 mill.

Length 25, breadth 10 mill.

Pass of France (Q. & G.); *Auckland to Dunedin* (Hutton), *New Zealand*, on stones below low water-mark.

Chiton zelandicus Q. & G., Zool. Voy. de l'Astrol., iii, p. 400, t. 73, f. 5–8 (1834).—REEVE, Conch. Icon., f. 58.—*Acanthochites zealandicus* HUTTON, Man. N. Z. Moll., p. 117 (1880).—*Acanthochætes hookeri* GRAY, in Dieffenback's Travels in New Zealand, ii p. 262 (1843.)

This species has been reported from Japan (Schrenck, Amurl. Moll., p. 273) but incorrectly, the Japanese species being distinct.

The coloring is variable. Hutton writes: Mantle brown; spines pale green; valves generally greyish-black, more or less varied with

yellowish; often yellowish or reddish on the dorsal line; occasionally greenish. The spines on the mantle vary from green to brown. Green is the more common color in the north, while brown appears to be universal in Otago.

It is by no means certain that but one species of *Acanthochites* exists in New Zealand. Especial attention should be given to the form and denticulation of the tail valve of specimens from different New Zealand localities, in order to settle this question. Specimens before me seem to indicate a second species, but they are not perfectly preserved.

A. CARINATUS Adams & Angas.

Shell elongated; valves moderate, strongly carinated, beaked behind; whitish maculated with reddish-brown; very closely pustulose, in the middle smooth and black-brown; lateral areas indistinct. Girdle beset with minute white spicules, and bunches of pale spicules.

Length 30, breadth 16 mill. (*A. & A.*)

Port Jackson, New South Wales (Angas.)

Acanthochites carinatus AD. & ANG., P. Z. S. 1864, p. 194.—ANGAS, P. Z. S. 1867, p. 224.

A single specimen was collected by Angas. Mr. E. A. Smith has expressed the opinion that it is the same as the European species *A. discr pans* (Proc. Zool. Soc. Lond. 1891, p. 392), but this view needs confirmation, being founded probably on a study of the external characters only.

A. ASBESTOIDES Carpenter. Pl. 2, fig. 55.

Shell small, greyish-brown, with a pale line on each side of the middle of the central valves, slightly converging behind, leaving a dark-wedge shaped space between them. Surface covered with a coarseish granulation, the granules being somewhat flattened and those at the vertex of the central valves rather smaller than the rest. The lateral areas are not defined in these valves; the posterior curved margins are produced in the middle, at times almost forming a right angle; their insertion plates are large, thin, produced anteriorly with a very slight notch quite close to the hinder margin on each side; the sinus between them in front is deep and arcuate. The first valve has a straighter posterior margin than the succeeding ones, and a semicircular outline in front; the lamina of insertion is rather deep, thin, feebly striated exteriorly, and interrupted by five very small subequidistant notches. The last valve is conspicuously

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small, transversely subovate, depressed-conical, with a nearly central mucro; insertion-plate very large, laterally produced, with only two notches behind. Interior of the valves bluish. Mantle very minutely spinulose, bearing very conspicuous compact tufts of silky spicules along the sides, not at all unlike in their fibrous texture that of asbestos. Length 15 millim., width of the broadest central valve 5½. (*Smith.*)

Flinder's Island, Bass' Straits (Jos. Milligan); *Port Molle, Queensland* (Coppinger), *Australia.*

Chiton (*Acanthochiton*) *asbestoides Cpr. MS.*, SMITH, Zool. Coll. H. M. S. 'Alert,' p. 83, t. 6, f. G (1884.)

Numerous specimens are before me from the collection of the Canada Geological Survey. The species is characterized by the density of the narrow white asbestos-like tufts, well shown in the figure.

(3) *Species of Japan, China, and the Sandwich Is.*

A. RUBROLINEATUS Lischke. Pl. 2, fig. 50.

Shell oblong-ovate, convex, very minutely granose, dull flesh-colored, here and there brown, having a wedge-shaped olive spot in the middle of the valves, and painted with obliquely longitudinal red lines. Sides of valves in large part covered by the girdle, the free portion about as long as wide. Anterior valve regularly convex; posterior valve small, obtusely beaked; the rest having a narrow smooth median area, slightly excavated on each side. Girdle clothed with minute, irregular spines, and 18 pores bearing dark bristles.

Length 34, breadth 20 mill. (*Lischke.*)

Nagasaki, Japan.

Chiton rubro-lineatus LISCHKE, Malak. Blätt. xxi, p. 24 (June, 1873); Japonische Meeres-Conchylien, iii, p. 73, t. 5, f. 12 (1874.)

Described from a single specimen. Compare *A. achates.*

A. ACHATES Gould.

Shell narrow, elliptical; sooty, with a yellow streak on each side Valves scale-shaped, beaked and carinated, at the apices smooth and ebony colored, elsewhere scaly-granulated. Anterior valve semi-oval; posterior valve small, triangular, the mucro subterminal; interior glaucous. Ligament wide, provided with short, unequal spines and bunches of spicules.

Length 30, breadth 20 mill. (*Gld.*)

Kikaia and Hakodadi Bay, Japan (Stimpson.)

C. (*Acanthochætes*) *achates* GOULD, Proc. Bost. Soc. Nat. Hist. vii, p. 165; Otia Conch., p. 118.

One of the orginal specimens of this species is before me, but it is so eroded that the characters are quite obscured.

A. DEFILIPPII Tapparone Canefri. Pl. 2, figs. 45–48.

Shell ovate, the valves small; girdle closely hairy, very wide. Valves heart-shaped, narrowed in front, dilated, and somewhat beaked in the middle behind; last valve small, subrotund. Umbones obscurely transversely striated, areas minutely and closely granulated. Girdle much dilated, thick, densely covered with short hairs, and having two series of setigerous pores. Color of the valves black-brown, sometimes variegated with white; girdle olive-brown, the pore tufts black. (*T.-C.*)

Yokohama, Japan.

Amycula de-filippii T.-C. Zool. del Viaggio intorno al globo della R. Fregata 'Magenta,' Malacologia, p. 78, t. 1, f. 15, 15*a*-2*c*. (1874). —*Stectoplax porrecta* CPR., *MS.* and in Dall, Proc. U. S. Nat. Mus. 1881, p. 288 (no description.)

Canefri's figure of this species shows but seven valves, probably a mistake of the artist.

The species described by Carpenter seems to be identical. Carpenter's name was applied some years before the appearance of the Zoology of the 'Magenta,' but unfortunately was never published. The Carpenterian species is evidently what Tapparone-Canefri alludes to as a species of "*Stretochiton*" in the collection "del sig. E. Adams." Carpenter's description is as follows:

A. porrectus Carpenter. (Pl. 2, figs. 36–44). Valves two-thirds immersed, brown-olive; exposed part of the posterior valve rounded, the mucro a little behind the middle; anterior valve semicircular; median valves trilobed, projecting far forward at the ridge. Dorsal area smooth, in the young shell longitudinally striate and granulose. Side areas conspicuously granose.

Interior: posterior valve mopaloid, slightly sinuated behind, having one slit at each side. Anterior valve having 5 slits; median valve 1 slit (or sometimes abnormally 2 on one side); posterior teeth long, the rest very long; eaves minute. Jugal sinus very deep, wide, smooth, sutural laminæ separated.

Girdle produced in front, covered with countless minute whitish glassy spines, and having tufts of hairs at the margins of the valves.

Length 44, breadth 27½ mill.; divergence 120°.

Japan (Cuming Coll., no. 97.)

This curious shell may be described as a *Katharina* with the normal tail-plate of *Acanthochites*, and a pore-bearing girdle. The hairs in the pores are horny, but over the surface white and nearly translucent. (*Cpr.*)

This species was made the type of Carpenter's subgenus *Stectoplax*, on account of the valves being two-thirds covered; but some species of *Acanthochites* have them even more immersed (such as *A. exquisitus* Pils.), and others form a perfect transition to the less covered forms.

A portion of girdle and valves is shown of the natural size in fig. 44. Figures 41–44 were drawn by Mr. E. A. Smith from the type in the British Museum. Figs. 36–40 were drawn by Emerton from Carpenter's specimens, collected by Arthur Adams.

A. CIRCELLATUS Adams & Reeve. Pl. 2, figs. 53, 54.

Shell oblong ovate, valves somewhat produced posteriorly, smooth, peculiarly sculptured with circular grooves. Jet black. Ligament densely beset with short bristles spreading over the sides of the valves, and furnished with small tufts of spicules. (*Rve.*)

This is the largest of the tufted species, and quite peculiar in its style of sculpture; the valves in all others are minutely granulated, but in this they are smooth and characterized by a number of fine grooves radiating in concentric order from the umbones. (*Rve.*)

Island of Quelpart, Corean Archipelago (A. Adams.)

Chiton circellatus Adams & Reeve, REEVE, Conch. Icon., t. 27, f. 180 (Oct., 1847.)

A. SCUTIGER Adams & Reeve. Pl. 2, figs. 51, 52.

Shell elongated, narrow; valves smoothly keeled in the middle, slightly beaked, minutely and very closely granulated; peculiarly burnt-red color. Ligament densely bristled, spread over the sides of the valves, and furnished with small tufts of spicula. (*Reeve.*)

Island of Quelpart, Corean Archipelago (A. Adams.)

Chiton scutiger Ads. & Rve., REEVE, Conch. Icon., t. 27, f. 178 (Oct., 1847). Probably not *Acanthochites scutiger* ANGAS, P. Z. S. 1865, p. 188, and 1867, p. 224.—*Cf.* Cooke, Ann. Mag. N. H. 1885, p. 276, and Smith, P. Z. S. 1891, p. 392.

The figures of Reeve indicate that this is a form in which the girdle encroaches much at the sutures, and the valves are coarsely granulated, somewhat as in *A. rhodeus*. Mr. E. A. Smith's inability to separate it from the minutely granulated *A. discrepans* is therefore not easy to understand.

A. ARMATUS Pease.

Shell ovate, slightly oblong, elevated-convex. Greenish irregularly maculated with black, pale in the middle, with two longitudinal black lines. Lateral areas granulose, central longitudinally striated, not beaked. Girdle leathery, narrow, with shining white spicules, and having tufts of silvery-white, glassy spicules.

Length 10, breadth 6 mill. (*Pse.*)

Oahu, Sandwich Is.

(*?*) *Acanthochites armatus* PSE., Amer. Journ. of Conch. vii, p. 195 (1871.)—*Aconthochites bœticus* CPR. *MS.*

A single specimen of this species before me is too much eroded for illustration. The species is quite similar to Gould's *A. achates* in general aspect.

A. VIRIDIS Pease.

Shell oblong ovate, but slightly elevated, green with a pale or whitish line down the middle. The valves are semi-lunar in shape, the posterior side being straightly transverse or nearly so. They are without a ridge or umbonal elevation in the centre, where they are smooth; the sides minutely granulose. The valves of insertion are entire plates on which the dorsal valves are set or imbedded. They extend from the sides of the dorsal valves, and produced anteriorly, the edges being smooth and rounded at their termination. On the posterior terminal valve, they are produced laterally, and are truncate at their termination. On the anterior terminal valve, they are produced at an equal distance around the front and sides. They are smooth and of a light bluish color. The ligamental border is covered with close-set short spiculæ. The spiculæ of the tufts are dense, vitreous and dark green. (*Pse.*)

Length 40, breadth 14 mill.

Kauai, Sandwich Is. (Pse.)

(*?*) *Acanthochites viridis* PSE., Amer. Journ. Conch. vii, p. 194 (1871.)

(4) *Species of the West Indies and West America.*

A. SPICULOSUS Reeve. Pl. 13, figs. 60, 61, 62.

Shell somewhat elongately ovate, valves semilunar, rough throughout; blackish-brown; ligament horny, furnished with thick tufts of bright olive glassy spiculæ. (*Reeve.*)

West Indies.

Chiton spiculosa REEVE, Conch. Icon., t. 9, f. 47 (Feb., 1847).—*Acanthochiton spiculosus* CPR. *MS.*

This form is probably merely a dark specimen of the species afterward described by Reeve as *C. astriger*. Mr. E. A. Smith has expressed his belief that this is the case, in Journ. Linn. Soc. Lond. xx, p. 497.

Var. ASTRIGER Reeve. Pl. 13, figs. 55, 56, 57.

Shell oblong, rather depressed, not carinated. Valves variously colored, green or olive-green, usually tinged with brown on the sides, often marked with rather wide white stripes at the sides.

The valves are generally more or less encrusted. Dorsal areas narrow, slightly raised at the edges, convex and shining, marked by delicate longitudinal striæ and transverse growth-lines. *Lateropleural areas very minutely and evenly granulated, the granules rounded.* Posterior valve small, *its tegmentum slightly longer than broad, the mucro near the posterior margin.*

Interior blue-green; sinus wide, deep and subangular; suturallaminæ large, blue-green. *Insertion-plate of the posterior valve visible behind*, as well as at the sides of the tegmentum when viewed from above; posterior outline bilobed, having a median sinus, and slits outside of the lobes.

Girdle minutely velvety, olive-green, having 18 very large conspicuous tufts of greenish-white spicules; the periphery bearing a fringe of spicules.

Length 20–22, breadth 9 mill.

Florida Keys to Barbados, West Indies.

Chiton astriger REEVE, Conch. Icon., t. 18, f. 109 (April, 1847). —*Phakellopleura* (*Acanthochites*) *astrigera* SHUTT., Bern. Mittheil. 1853, p. 79.—*Acanthochiton astriger* DALL, Bull. 37, U. S. Nat. Mus. p. 174.—*Chiton* (*Acanthochiton*) *astriger* SMITH, Journ. Linn. Soc. Lond. xx, p. 496 (1890.)

Additional localities are: Guadeloupe (*Swift*); St. Thomas (*Blauner*); Tortugas (*Dall*), and Fernando Noronho (*Ridley and Ramage.*)

In *astriger* the pustules are very minute, crowded, and rounded, each with a small central pit, as shown in fig. 56. The dorsal areas are wide, triangular and closely striated longitudinally.

A. PYGMÆUS Pilsbry, n. sp. Pl. 13, figs. 58, 59.

Small, oblong, elevated, carinated, the side-slopes flat. Uniform cream-white or olive-green, or variegated.

Intermediate valves broad, somewhat beaked. *Dorsal areas wide, triangular,* sculptured with longitudinal striæ. Latero-pleural areas evenly covered with rather large flattened pustules, which are rounded or but slightly ovate, and average one-tenth of a mill. in greatest diameter. Posterior valve having the tegmentum oval, wider than long; mucro prominent, subcentral.

Interior blue or flesh-white. Posterior valve nearly semicircular in outline behind, having a slit on each side, and a very slight upward wave behind. The insertion-plate is short behind.

Girdle narrow, having 9 small tufts of silver-white spicules on each side, and an irregular fringe at the edge.

Length 8, breadth 4 mill.; divergence 100°.

Cedar Keys and Key West, Florida (Hemphill.)

This is the smallest species of the genus known to me. It differs from *A. spiculosus* in the smaller size, and high, roof-like form, in the smaller tufts, comparatively much longer tegmenta, and in the shape of the pustules, which are as coarse as in *spiculosus,* although the shell is so much smaller. The posterior valve differs widely from that of *spiculosus.*

A. EXQUISITUS Pilsbry, n. sp. Pl. 12, figs. 44, 45, 46, 47.

Oblong, *the visible portion of the valves very narrow,* generally less than one-fourth the entire width of the dried animal; depressed. Valves dark olive color; girdle of dried specimens light green, *the tufts very large* and either green, pink or bronze colored. In well-preserved alcoholic specimens the girdle is very fleshy and wide, light yellow with green pubescence.

The median valves are but slightly beaked, the tegmentum being *extremely narrow, its area far less than that of one of the sutural-laminæ.* Dorsal area a rather narrow, longitudinally striated band, wider in front. Side areas narrow, sculptured with separated, flat-topped granules, round posteriorly, ovate or drop-shaped and concave toward the anterior of each valve (fig. 47). Exposed portion of anterior valve much shorter than the front slope of the insertion-

plate. Posterior valve having the tegmentum very small, *ovate*, narrower in front, *longer than wide*, mucro situated at the posterior third.

Interior blue, darker along the cavity; sinus narrow, deep, subangular. Sutural laminæ very large. Posterior valve biangular behind, strongly contracted on the latero-posterior sides.

Girdle very wide, covering all but a narrow shield of each valve; covered with a close, short velvety pile which has a longer fringe around each valve; bearing 18 *unusually large, dense tufts of excessively fine spicules, usually 5–7 mill. long.*

Length 25–30, breadth 15–18 mill.

La Paz, Lower California (W. N. Lockington.)

This is one of the largest as well as the most beautiful species of the genus. The valves are more covered than in any other known form, and the bunches of shining bristles are larger. A large number of individuals preserved in alcohol and dry were presented to the Academy by Mr. W. N. Lockington, (no. 60107.)

One specimen before me has the girdle pubescence of a pale buff tint, and the tufts are silvery, a trifle bronzed.

Var. AMPULLACEUS Pilsbry. Pl. 4, fig. 85.

Similar to the preceding, but exposed portion (tegmentum) of intermediate valves much broader behind, flask-shaped; the lateral borders sigmoid. Tegmentum of anterior valve also larger.

A. AVICULA Carpenter.

Shell very similar to *A. arragonites* in form, size, girdle and general habit; but the sculpture and terminal laminæ are different. Dorsal ridge having about 6 longitudinal grooves, the intervals appearing flatly scaled; umbones wide; diagonal areas hardly defined; sides ornamented with oval, flattened scales, large for the size of the shell, and in indistinct diverging series. Mucro small, situated in front. Color livid and olivaceous-brown variously stained. Plates of insertion at sides as in *A. arragonites;* anterior plate with 5 slits.

Length 4, breadth 2½ mill. (*Cpr.*)

Catalina Island, 10–20 fms.; rare (Cal. State Coll., no. 1072. Cooper.)

Acanthochites avicula CPR., Proc. Cal. Acad. Nat. Sci. iii, p. 211 (Feb., 1866.)

Like *A. arragonites*, but valves sculptured in large snake-skin pattern. (*Cpr.*)

Var. DIEGOENSIS Pilsbry, n. var. Pl. 12, figs. 52, 53, 54.

Shell oblong, rather elevated, carinated, the side-slopes straight. Color buff or light gray, mottled on the sides with olive or olive-black; girdle light green with whiter sutural tufts.

The intermediate valves are rather minutely and acutely beaked when not eroded; are wide posteriorly, tapering anteriorly, but the girdle does not encroach much at the sutures. Dorsal areas narrowly triangular, having about a dozen flattened longitudinal striæ separated by narrower grooves. Latero-pleural areas covered with a rather coarse but regular scale-like granulation, the granules flat, oblong. Posterior valve having the tegmentum covering the greater part of the articulamentum, somewhat diamond shaped, *wider than long*, with *the prominent mucro at the posterior third.*

Interior blue-green; sinus rather wide, angular; sutural laminæ moderate sized, rounded. Posterior valve obscurely bilobed behind, gently curved upward in the middle of the posterior insertion plate.

Girdle (*fig.* 53) *densely clothed with rather long, light green spicules,* and having 18 or 20 tufts of longer whiter spicules, the tufts usually not very conspicuous, and sometimes a few of them are lacking.

Length 19, breadth 9 mill.; divergence 110°.

Length 18½, breadth 8 mill.; divergence 110°.

Length 11, breadth 6 mill.; divergence 110°.

San Diego, California (Hemphill.)

This may prove to be the adult form of Carpenter's *A. avicula;* but on account of the obvious discrepancy between my specimens and his description, it seems best to retain it under a separate name pending the re-examination of Carpenter's type.

The covering of the whole girdle is more developed than in most species, resembling velvet with a deep pile; and the tufts are less conspicuous than usual. The pustules are all drop-shaped and flat-topped. Black ones are scattered among the others, which are light colored, often almost whitish. The ridge has ten or a dozen exceptionally deep longitudinal striæ (fig. 54.)

A. ARRAGONITES Carpenter.

Shell elongated, elevated (at an angle of 110°), pale brown, variedly painted with rose and olivaceous.

Intermediate valves strongly beaked, the interstices strongly diverging from the beaks; dorsal area wide, pale, very delicately longitudinally granulate-striate, transversely most minutely corrugated; lateral areas indistinct; surface all strongly granulated,

furnished with an elegant pattern of sphæroidal tubercles and chains of granules in lines diverging from the ridge. Posterior valve having the mucro subcentral and subconspicuous.

Interior roseate or white; the acute and lobed margins of the valves not separated, large, with a single slit on each side, the lobes angulate; sinus large, flat; very delicately wrinkled in the cavity of the ridge, laminated under the beaks. Posterior valve hexagonal, with two posterior slits.

Girdle copiously adorned with translucid, erect spicules, and at the front and hind ends and sutures having tufts of spicules or needles. (*Cpr.*)

Length 4, breadth 1½, alt. ½ mill.

Mazatlan, on *Spondylus calcifer* (Liverpool Coll.)

Acanthochites arragonites Cpr., Catal. of Mazatlan Shells, p. 198 (1857.)

Whether the varied coloring of this shell, its elegant sculpture, the bird-like form of the medial or hexagonal shape of the bifissured terminal valves, or the adornment of the mantle with the transparent needle-like hairs, rising now in tufts, now in irregular crystals, be examined under the microscope, it would be difficult to find any shell of such surpassing beauty. Only one perfect specimen was found, but fresh valves belonging to several other individuals were detected among the Spondylus washings. The valves in the same shell greatly differ in color as in *L. albolineatus*. The posterior valve is peculiarly exquisite in its form, color and sculpture. There is considerable variation in the size of the tubercles and in the striation of the jugum. (*Cpr.*)

A. rhodeus Pilsbry, n. sp. Pl. 12, figs. 48, 49, 50, 51.

Oblong, the exposed portion of the valves about one-third the entire width of the animal. Valves depressed, obtusely carinated, brown, the eroded apices roseate.

The intermediate valves appear almost separated by the encroachment of the girdle at the sutures; a heart-shaped or subtriangular area remaining exposed. *Dorsal band sharply defined and strongly differentiated from the side areas, very narrow,* shining, having slight growth-lines *but no longitudinal striæ.* Latero-pleural or side areas *sculptured with rounded-oval concave-topped elevations* arranged in rows subparallel to the ridge, becoming radial and then irregular at

the sides. Posterior valve having *the tegmentum drop-shaped, narrower in front, longer than wide; mucro at the posterior fourth.*

Interior deep rose red, paler at the edges of each valve. Slits rather deep and narrow, arranged as usual. *Insertion plates of all valves very distinctly rugose outside.* Posterior valve normally slit; not noticeably bilobed behind.

Girdle wide and fleshy in alcoholic specimens, having 18 conspicuous tufts.

Gills extending forward two-thirds the length of the foot.

Length 28, breadth 15 mill. (alcoholic specimen.)

Panama (McNeill Expedition.)

Described from an alcoholic specimen which has lost the cuticle and hairs from its girdle leaving a smooth whitish surface pitted at the sutures. The salient specific characters are (1) that the girdle encroaches much at the sutures; (2) that the substance of the valves is rose-red; and (3) that the sculpture is altogether peculiar. The insertion-plates are uncommonly rugose outside. It differs from *A. hemphilli* in the normal 2-slit posterior insertion-plate.

The pustules (pl. 12, fig. 49 x 60) are mainly rounded or short drop-shaped, and are arranged in regular rows. They become somewhat more spaced and less regularly arranged at the sides, and the valve illustrated has suffered erosion toward the beak. The individual pustules (fig. 49) are seen to be decidedly concave. The dorsal area is narrow, elevated and smooth except for growth striæ. The insertion and sutural plates are distinctly and sharply striated.

A. HIRUDINIFORMIS Sowerby. Pl. 2, figs. 56, 49.

Shell oblong, flattened, blackish-green. Valves rounded, granulose; central areas elongated, acuminate behind, smoothish. Girdle very densely pilose, velvety, with 9 concolored bunches of hairs.

Length 25, breadth 14 mill. (*Sowb.*)

Ancon, Lobos Island and Payta, Peru; Chatham Island, Galapagos, under stones at low water.

Chiton hirudiniformis SOWB., P. Z. S. 1832, p. 59; Conch. Illustr. f. 23, 142.—REEVE, Conch. Icon., t. 10, f. 54.

A. STYGMA Rochebrune. Pl. 8, figs. 31, 32.

Shell ovate-elliptical, the shell quite wide, pale brown, each valve regularly encircled with a wide concentric black band. Anterior valve rounded; posterior small, somewhat swollen; intermediate valves having the central and lateral areas most minutely punctic-

ulate, surrounded by a wide smooth band. Girdle tawny, ornamented with gleaming white, glassy tufts.

Length 35, breadth 20 mill. (*Rochebr.*)

Strait of Magellan.

Acanthochiton stygma ROCHEBR., Miss. Sci. du Cap Horn, vi, Zool., p. 134, t. 9, f. 2a, 2b (1889). Not *C. stigma* Costa.

It is evident that but little dependence can be placed on the figures of this species.

A. BISULCATUS Pilsbry, n. sp. Pl. 4, figs. 86, 87.

Oblong, elevated, carinated, the side-slopes flat and straight. Buff, maculated with olive-green and dark green, or greenish with dark green and blackish mottling.

Anterior valve having the evenly granulated tegmentum extending two-thirds of the distance to the edge of the teeth. Intermediate valves (fig. 87) having a very broadly heart-shaped tegmentum; the dorsal area triangular, convexly raised, longitudinally striated. *Latero-pleural areas distinctly concave or hollowed out on each side of the dorsal area;* covered with rather thickly distributed, drop-shaped flat or concave pustules (fig. 86) averaging about one-sixth of a mill. long. *Posterior valve having the tegmentum symmetrically oval,* the long axis of the oval transverse to that of the animal; mucro prominent, subcentral.

Interior bluish. Insertion-plates and teeth normal. Tract behind the sinus spongy. Posterior valve having one slit on each side, but hardly a perceptible sinus behind.

Girdle rather wide, densely clothed with whitish spinelets, and having 9 tufts on each side.

Length about 22, breadth about 9 mill.; divergence 100°–110°.

Habitat unknown.

Although the habitat of this species is unknown to me, I anticipate no difficulty in its recognition. The shallow but distinct sulcus on each side of the dorsal area is a diagnostic feature, but unfortunately is not shown in the figure.

(5) *Undetermined, and unrecognizable species of Acanthochites.*

ACANTHOCHITES TRISTIS Rochebr. Shell broad, ovate, sooty, carinated, subumbonate. The anterior valve rounded, posterior swollen; intermediate valves having the central areas transversely roughened; lateral areas with sparse, wide tubercles. Girdle wide,

sooty, with 9 whitish tufts. Length 25, width 14 mill. (*Rochebr.*, in Bull. Soc. Philom. Paris, 1881–'82, p. 194.)

New Holland (Dussumier; Paris Mus.)

ACANTHOCHITES TURGIDUS Rochebr. Shell small, ovate-oblong, pale buff. Anterior valve elongated, posterior rounded, nearly concealed; intermediate valves rounded, covered throughout with swollen tubercles. Girdle gray, with 9 blue tufts. Length 10, breadth 6 mill. (*Rochebr.* in Bull. Soc. Philom. 1881–'82, p. 194).

New Holland (Peron & Lesueur; Paris Mus.)

ACANTHOCHITES JUCUNDUS Rochebr. Shell ovate-elongate, buff, with emerald-green lines and spots. Central areas of intermediate valves smooth; lateral areas sculptured with radiating beaded lines. Girdle wide, roseate, with 9 green tufts. Length 24, breadth 13 mill. (*Rochebr.* in Bull. Soc. Philom. 1881–'82, p. 194.)

New Holland (Belligny); *Cook's Straits* (Filhol). Not common; Paris Mus.

ACANTHOCHITES STERCORARIUS Rochebrune. Shell elliptical rather flat, dull olivaceous; anterior valve rounded; posterior small, swollen; intermediate valves with the central area rugose, lateral areas covered with wide, concentric imbricating sulci. Girdle wide, thick, shistaceous, with 9 greenish bunches. Length 22, breadth 13 mill. (*Rochebrune*, in Bull. Soc. Philomath. de Paris, 1883–'84, p. 32, 1884.)

Cape Roxo, west coast of Africa (Paris Mus.)

ACANTHOCHITES BELLIGNYI Rochebrune. Shell elongated; ashen, marbled with white and tawny. Anterior valve rounded elliptical, posterior very minute; intermediate valves having the central areas smooth, lateral areas concentrically scaly, scales spatuliform. Marginal ligament rather wide, brown, with 9 blue bunches. Length 15, breadth 8 mill. (*Rochebr.*, in Bull. Soc. Philom. Paris, 1883–'84, p. 37, 1884.)

New Caledonia (Paris Mus.)

ACANTHOCHITES DAKARIENSIS Rochebr. Shell elongated, buff, with a conspicuous black spot; anterior valve broad, rounded; posterior valve nearly covered, semi-lunate; intermediate valves rounded, scale-shaped, beaked behind, granulose, the granules subimbricated; anterior area of the valves wide, longitudinally sulcate, the sulci chain-like. Marginal ligament wide, pilose, blackish, beset

very densely with whitish hairs; bunches 9, glassy, intense green. Length 35, breadth 12 mill. (*Rochebr.* in Bull. Soc. Philomath. 1880–'81, p. 116; Journ. de Conchyl. 1881, p. 44.)

Rocks of Dakar, west Africa (Paris Mus.)

ACANTHOCHITES JOALLESI Rochebr. Shell elongated, thick, almost always covered with a calcareous incrustation; anterior valve semilunar; posterior valve rounded, small; intermediate valves rounded in front, semi-lunate behind; lightly scaly at the base only. Marginal ligament very broad, olivaceous, having sparse, whitish long hairs; 9 wide greenish bunches. Length 24, breadth 14 mill. (*Rochebr.* in Bull. Soc. Philom. Paris, 1880–'81, p. 117; Journ. de Conchyl. 1881, p. 45.)

Coast of Joalles; rocks of Rufisque, West Africa (Mus. Paris.)

CHITON ECHINOTUS Blainv. (Dict. Sc. Nat. xxxvi, p. 552). A species said to be from the Ocean coast (of France), figured in the Encyclop. Méth., pl. 163, f. 14, 15, copied from Chemnitz, vol. x, pl. 173, f. 1688. It is practically unidentifiable, but the figures were in all probability drawn from *Acanthochites discrepans.*

CHITON POLYCHETUS Blainville. Body very small, oval; girdle provided with 9 closely placed pairs of large tufts, the spicules equal, silvery. Shell very small; the disc of the intermediate valves quite large and having 5 nearly equal sides; plates of insertion moderate, unifissate far backward; that of the posterior valve with 3 nearly equal lobes. Color greenish-brown. (*Blainv.*, Dict. Sc. Nat. xxxvi, p. 553.)

Seas of New Holland.

CHITON ROSEUS Blainville. Body oval, a little elongated, subvermiform; girdle much extended, covered with a very great quantity of crowded hairs, concealing the very small tufts of bristles. Bodies of the intermediate valves subtriangular, the anterior summits truncated; covered with flat tubercles at the sides. Color of the shell rose; the rest of a gray black. (*Blainv.*, Dict. Sc. Nat. xxxvi, p. 553.)

New Holland.

Probably a species of *Notoplax.*

CHITON SUEURII Blainv. Body small, oval, *Oniscus*-like. Girdle with 9 pairs of tufts of quite small bristles. Intermediate valves having the body trapezoidal, with a brush-like group of striæ in the

middle, the plates of insertion of medium size. General color grayish. (*Blainv.*, Dict. Sc. Nat. xxxvi, p. 553.)

Port of King George.

CHITON SCABER Blainv. Body oval, elongated, a little vermiform having the girdle very thick and very wide, covered with quite fine hairs and small tufts. Shell small, occupying only a third of the back, formed of 8 thin, fragile valves, the intermediate ones larger than the terminal, exposed portion triangular and very small in comparison with the plates of insertion, which are wing-shaped. Insertion-plate of the anterior valve especially large, 6-lobed ; that of the posterior valve patelliform, with 4 lobes. General color of the shell whitish gray. (*Blainv.*, Dict. Sc. Nat. xxxvi, p. 553.)

Seas of New Holland.

Section *Notoplax* H. Adams.

Notoplax AD., P. Z. S. 1861, p. 385 (type *N. speciosa* H. Ad.).—*Macandrellus* CPR. *MS.* in DALL, Proc. U. S. Nat. Mus. 1881, pp. 284, 288 (type *M. plumeus* Cpr.)

Acanthochites in which *the posterior valve has the insertion-plate grooved outside and denticulate at the edge*, between the usual two latero-posterior slits. Tegmentum reduced in size by the encroachment of the girdle at the sutures, the valves nearly or wholly separated there. Anterior valve not distinctly ribbed radially, or lobed around the edge.

A rather weakly characterized section, probably artificial, but decidedly convenient at present as a means of splitting the large mass of Acanthochites. It is intermediate between typical *Acanthochites* and *Cryptoconchus* in characters. The girdle has the tufts rather smaller than in the more typical Acanthochites, and the spicular covering of the whole surface varies from nearly obsolete to a dense clothing.

The true nature of the girdle in *Notoplax* was not known to Dr. Dall when he wrote the notes upon the group in Bull. Mus. Comp. Zool. xviii, p. 417. In the typical species, *N. speciosa*, it exhibits all the characters of the girdle of *Acanthochites*. There seems to be no character of more than specific value separating *Notoplax* and *Macandrellus*. As to *Stectoplax*, which Dall (*l. c.*) thinks may prove to equal *Notoplax*, it is absolutely nothing but a genuine *Acanthochites*.

The type of *Macandrellus* is not *M. costatus* Ad. & Ang., as stated by Dall in Proc. U. S. Nat. Mus. 1878, p. 299, but *M. plumeus* Cpr., *teste* Dall, *l. c.* 1881, p. 288. The first use of the name, being unaccompanied by a diagnosis, will fall. At the time Carpenter established the group for *M. plumeus*, he had never seen the species *costatus*.

A. SPECIOSUS H. Adams. Pl. 1, figs. 23, 24, 25, 26.

Shell elongated; valves acutely heart-shaped, olivaceous maculated with brown; each valve with a wide, smooth dorsal ridge, the side areas coarsely granulose, the lateral area indicated by a raised line. Girdle brown, spinulose; pores moderate sized, encircled by conspicuous spicula.

Length 72, breadth 24 mill. (*H. Ad.*)

Tasmania (Mus. Cuming); *Flinders Island* (Jos. Milligan.)

Cryptoplax (*Notoplax*) *speciosa* H. AD., P. Z. S. 1861, p. 385.

This species resembles *A. exquisitus* Pils. in the narrowness of the exposed portion of the valves, but in typical specimens of that form the tegmentum is decidedly narrower. In *A. hemphilli* Pils. from Florida, which is a *Notoplax* in its apparently separated valves and denticulate tail-plate, the *speciosus* differs in the longer, narrower tegmentum, etc.

The figures of my plate were drawn by Mr. E. A. Smith from the types. Carpenter gives the following useful notes on the specimens in the British Museum: The lateral areas are distinctly marked off by larger granules along a raised diagonal line. The mucro of the posterior valve is raised, at an angle of about 160°, and situated at the posterior third of the tegmentum. The jugular areas are both smooth and raised; the scales of the sides are also smooth flat and raised. The girdle is entirely covered by a dense mass looking spongy, but consisting of spicules of moderate length and extremely crowded. There are conspicuous pores but the hairs in them are not longer than the rest, and therefore it is difficult to distinguish them. The sinus is very narrow and deep. Slits all very short. The anterior valve has grooves with raised edges extending from eaves to the slits. Posterior valve having side slits, situated as in *Acanthochites*, but the posterior plate is pretty regularly grooved radially, so as to crenate the margin, almost amounting to little nicks from slit to slit.

A. FORMOSUS Reeve. Pl. 1, figs. 12, 13 (enlarged.)

Shell oblong, rather narrow; valves very finely longitudinally striated at the summit, granulated at the sides. Bright scarlet. Ligament horny, thickly beset with shining white spicula at the side of each valve. Length $\frac{1}{2}$, breadth $\frac{3}{16}$ inch. (*Reeve.*)

Cape Rivers, N.-W. Celebes; one specimen.

Chiton formosus REEVE, P. Z. S. 1847, p. 25; Conch. Icon., t. 26, f. 173.—ADAMS & REEVE, Zool. 'Samarang,' t. 15, f. 8.

Carpenter believed his *MS.* species *Macandrellus plumeus* to be the same as this, although he had not, I believe, compared the types. His description is as follows:

A. plumeus Carpenter. Shell subelongate, subelevated, the dorsal ridge acute, mucro submedian, hardly raised, the slope behind it concave. Roseate at the sides, olivaceous in the middle. Exposed part of the valves small. Posterior valve subrotund; anterior valve pectinated and 5-angled around the margin; central valves strongly angular, beaked; sutures deeply encroaching on the side-areas. Dorsal areas delicately and closely sublongitudinally lirulate; lateral areas distinctly defined, sunken; central and lateral areas scaly in radiating, somewhat plumose pattern.

Interior: posterior valve hardly sinuated behind, having a slit at each side, the plate between them deeply grooved outside and subdentate, shallowly slit at the edge. Anterior valve having 5 slits, the teeth angular at the slits. Girdle leathery, smooth, sometimes somewhat spongy, having minute hairlets, and small tufts of hairs at the sutures. Length 21, breadth 11 mill.; divergence 120°.

Habitat unknown (Mus. Cuming, no. 108.)

Macandrellus plumeus CPR. *MS.;* and in Dall, Proc. U. S. Nat. Mus. 1881, p. 288 (no description.)

The irregular, rugose lobes of the tail plate, behind, almost amount to teeth. The head valve is hexagonal. The sculpture resembles the feathers of a bird. The lateral areas are distinct, but sunken instead of raised. (*Cpr.*)

A. ACUTIROSTRATUS Reeve. Pl. 8, figs. 27, 28.

Shell elongated, elevated in the middle, somewhat compressed at the sides; valves obtusely keeled at the summit, smooth; very closely flatly grained on each side; umbones produced, sharply beaked; lateral areas of the valves small, rather indistinct, concave. Whit-

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ish, stained here and there along the summit with black. Ligament horny, furnished at the side of each valve with a small crest of spicula. (*Rve.*)

Cape Rivers (Belcher.)

Chiton acutirostratus REEVE, Conch. Icon., t. 26, f. 137. July, 1847. Voy. Samarang, Moll., t. 15, f. 10.

An elongated species of somewhat compressed growth, remarkably distinguished by the sharply beaked structure of the umbones; the flat-grained sculpture of the valves approaches that of *C. hirudiniformis*, to which it offers a singular contrast of color. (*Reeve.*)

A. HEMPHILLI Pilsbry, n. sp. Pl. 13, figs. 65, 66, 67.

Elongated, the valves somewhat exceeding one-third the total width in dried specimens. Valves rather elevated, carinated; red, more or less maculated with white. Girdle rust-brown.

The intermediate valves are not beaked, being somewhat produced backward on each side of the apex; *tegmentum reduced to a heart-shaped area by the encroachment of the girdle at the sutures, leaving the valves in contact by only a small point* at the ridge. *The dorsal band is very narrow, parallel sided,* slightly elevated, and having a few longitudinal striæ. The latero-pleural or side areas are sculptured with fine flattened pustules, those on the posterior portion of each valve being concave. Posterior valve elevated, *the tegmentum small, somewhat pear-shaped, narrow in front, longer than wide,* mucro at about the posterior third.

Interior light green at the sides, deep rose-red in the middle and at the posterior margin of each valve. Sutural-plates light greenish, the slits minute. *Posterior valve not bilobed behind,* having the usual two slits, *and between them a number* (6–8) *of smaller, irregular and unequal slits or nicks;* posterior sinus obsolete.

Girdle wide, rusty-brown, sparsely clothed with short microscopic hyaline spicules, having a fringe of longer spicules at the periphery, and 18 rather small tufts of whitish bristles.

Length 24, breadth 11 mill.; divergence about 115°.

Key West, Florida (Henry Hemphill.)

This species is allied to *A. rhodeus* in the peculiarly narrow dorsal band, the great encroachment of the girdle at the sutures, etc.; but it differs in the less developed side slits, the higher and narrower tail valve and its peculiar multiple-slitting, and in other features. It was collected by Mr. Hemphill at Key West. There

are other specimens in the collection of the Geological Survey of Canada, without locality.

The pustules are rounded, flat-concave topped, crowded, and arranged in distinct series. The dorsal area projects anteriorly beyond the latero-pleural areas; it is narrow, elevated and longitudinally striated, the striæ mostly rather indistinct and subgranulated. The white and crimson pattern gives an appearance of great elegance to the valves.

A. CARPENTERI Pilsbry, n. sp. Pl. 1, figs. 14–22.

A series of drawings left by Dr. Carpenter, represent an unnamed new species of *Macandrellus*, of which he had prepared no description. It is so strongly marked, however, that the recognition of the form will be easy. Its prominent features are: (1) the broad, anteriorly produced, slightly asperulate girdle with minute pore-tufts; (2) the slightly scalloped border of the anterior valve (tegmentum); (3) the coarse scale-like granulation of the side areas; and (4) the distinct slitting of the posterior insertion-plate into even, vertical teeth. Length 41, breadth 23 mill.

Port Elizabeth, S. Africa.

The figures of detached valves are double natural size. Compare *Spongiochiton.*

A. INVOLUTUS Carpenter, n. sp. Pl. 1, figs. 27–35.

An unpublished species, of which excellent figures by Emerton were prepared for Carpenter. These are reproduced upon my plate, and are sufficient for the recognition of the species, although the sculpture is represented upon the head valve only. All the figures are magnified two diameters. Carpenter gives only the following notes: There are only six stumpy [branchial] leaflets on each side of the tail; vent inconspicuous; foot slight and very thin. Head very small, with copious "veil" and neck lappets, outside of which there is a sort of hood around the head, extending backward to the gills (fig. 33), without epidermis, like the foot; outside of all is the large girdle covered inside with granular epidermis."

Zanzibar (Mus. Comp. Zool.)

The figures were drawn from alcoholic specimens.

Section *Cryptoconchus* Blainville & Guilding, 1829.

Cryptoconchus (BLAINVILLE *MS.* in Brit. Mus.; BURROW, Elem. Conch., p. 190), GUILDING, Zool. Journ. v, p. 28 (1829).—GRAY, P. Z. S. 1847, p. 66, 69, 169. Type *C. porosus.*

Valves entirely covered by the girdle *except a linear area at the ridge of each. Posterior valve having the insertion-plate with several* (5–7) *slits*, anterior valve 5-slit. Girdle leathery, naked, bearing a series (18) of sutural tufts on tubercles, or pores, sometimes subobsolete, along the sides of the valves. Gills extending along the posterior half of the foot.

This subgenus cannot in fairness be dated from the time of its pullication in Burrow's *Elements*, for in that work it is in no way defined and is disowned as a valid genus. Burrows simply says that Blainville has affixed the names *Cryptoconchus porosus* and *C. larvæformis* to two specimens in the British Museum. The latter belongs of course to *Chitonellus*. In 1829, Guilding adopts *Cryptoconchus* as a genus, and gives a generic diagnosis. Blainville himself ignores the name in his publication on Chitons in 1825, believing it a synonym of *Chitonellus*.

This group is much more closely allied to *Acanthochites* than to *Amicula;* its valves being exactly the form which would be produced by a little further covering of the side areas in a species like *A.* (*Notoplax*) *hemphilli*. The backward prolongation of the sides into posterior lobes is just as great in that species; the main difference being that in *Notoplax* these posterior lobes are not covered by the girdle. The structure of the tail valve is practically the same in *Notoplax*, *Loboplax* and *Cryptoconchus*.

A. POROSUS Burrow. Pl. 3, figs. 57, 58, 59, 60, 61, 62.

Shell elongated, all but a linear dorsal area of each valve covered by the integument continued upward from the girdle, but in the dried state showing through it the posterior outlines of the valves. Color when dry dark reddish or blackish-brown.

The outer layer of each intermediate valve is reduced to a narrow dorsal area, shaped like an exclamation point without the dot (!); upon each side of the apex, *the posterior margin of each valve is produced backward in a rounded lobe*, showing plainly through the contracted outer skin. A more or less developed groove extends to the lateral slits. Head and tail valves with minute circular exposed dots.

Interior light blue-green. Anterior valve having 5, median valves 1, posterior 5–7 slits.

Girdle reddish- or blackish-brown in the dried condition, *naked, smooth, leathery; bearing a series of prominent tubercles each with a*

bunches of short bristles, situated near the sutures upon the sides of the valves, and four around the head valve.

Length 34, breadth 14 mill. (dried specimen.)

Length 38, breadth 20 mill. (*Q. & G.*)

Dunedin to Auckland, New Zealand.

Chiton porosus BURROW, Elements of Conchology, p. 189, t. 28, f. 1 (1815).—*Cryptoconchus porosus* H. & A. AD., Gen. Rec. Moll. iii, t. 55, f. 4.—CHENU, Manuel, i, f. 2884.—HUTTON, Man. N. Z. Moll., p. 118 (1880).—*Chiton monticularis* QUOY & GAIMARD, Voy. de l'Astrol., p. 406, t. 73, f. 30–35, (1834).—SOWB., Conch. Illustr., f. 129.—REEVE, Conch. Icon., t. 10, f. 57.—*Chiton leachi* BLAINVILLE, Dict. Sc. Nat. xxxvi, p. 554 (1825).—? *Cryptoplax depressus* BLAINV., *l. c.*, vol. xii, p. 124 (1818).—? *Cryptoconchus stewartianus* ROCHEBR., Bull. Soc. Philomath. Paris, 1881–1882, p. 194.

The girdle varies from bright orange to light brown in the living animal (figs. 57, 58). The gills are posterior.

A. FLORIDANUS Dall. Pl. 3, figs. 63, 64.

Elongated and narrow; black, purple-black or light brown, with a linear white space along the summit of each valve.

Valves entirely covered except a round dot at the apex of the first, and a narrow band along the ridge of the other seven, the band slightly dilated at the apex of each valve. These exposed portions are whitish or purplish, smooth or showing faint transverse growth striæ. The posterior edges of each valve, seen through the dried skin, are produced backward in wide but not deep rounded lobes on each side of the apex. Posterior valve with subcentral mucro.

The disconnected valves are white or pink and purple; the intermediate valves being rectangular in general shape, with a sinus before and behind, the posterior sutural lobes rather narrower than the anterior; and there is one slit on each side. The posterior valve has a gentle wide upward wave posteriorly, with a single Mopaloid slit on each side, and several (4) unequal slits between them. Anterior valve having 5 slits.

Girdle rather wide, leathery, naked; when fresh having the color and "texture of a moist prune"; bearing at each suture a minute bristle-pore, and four such pores around the head valve; each pore bearing some short bristles, scarcely projecting above the surface; pores and bristles always inconspicuous, frequently invisible (aborted?).

The gills extend forward half-way to the head.

Length 21, breadth 7½ mill. (dry specimen.)

Length 24, breadth 13 mill. (large alcoholic specimen.)

Key West and Key Largo, Florida, on the reefs near low tide (Hemphill); *Dry Tortugas* (Dr. E. Palmer); *Cape Florida* (Wurdeman.)

Notoplax floridanus DALL, Bull. Mus. Comp. Zool. xviii, Report on the 'Blake' Mollusca, p. 416, (1889.)

This species attracts the attention at once by its dark, glistening girdle, and the long line of white strokes along the median line, like exclamation points without the dots (!). It resembles no known species but *A. porosus* Burrow, of New Zealand; but the latter differs in having the dorsal stripes slightly more reduced, and in having a row of projecting pore-hillocks along each side. In *floridanus* the pores are extremely indistinct even in alcoholic specimens, and in dried examples they can only be detected by looking through the specimen at a strong light.

One of the specimens before me, collected by Hemphill lacks black pigment in the girdle, being of a light brown tint. It is probably an albino. Dall says that the portion of the tail plate between the (two) notches is not serrate, but in my specimens it is very distinctly slit. The number of pores around the front margin of the head valve is not 5, but 4, as is the rule in *Acanthochites* and its subgenera; this of course does not include the two at the suture.

Section *Loboplax* Pilsbry, 1893.

Phacellopleura CPR. *MS.*, not *Phakellopleura* Guilding.

Valves partly covered, the *anterior valve having 5 radiating ribs, and the same number of lobes* along the margin; the posterior valve having the insertion-plate grooved outside, *notched and slit along the edge*, between the usual postero-lateral slits. Girdle leathery, having minute sutural tufts. Gills (of *A. violaceus*) extending along the posterior two-thirds of the foot.

In the nakedness of the girdle and the form of the individual valves, as well as the strong denticulation of the posterior valve, this group recalls Katharina; but in that genus there are no sutural girdle-pores or tufts whatever, and the tail valve is quite distinctly sinused behind. *Loboplax* differs from *Notoplax* in the lobed and ribbed head valve, the more distinct posterior slits, and more naked girdle.

Carpenter considered "Phacellopleura" (*porphyretica, violacea*) a genus of Ischnoid Acanthopleuroids, but he describes *A. costatus* in *Acanthochites*. I cannot give the group generic rank because *Notoplax* connects it with *Acanthochites*.

A. VIOLACEUS Quoy & Gaimard. Pl. 3, figs. 67–73.

Elongated, rather depressed; the valves all of the same width except the last which is narrower. Color typically a rich, dark purple-brown, the girdle darker, varying to violet with a buff triangle at the ridge of each valve enclosing a purple stripe or series of spots; or sometimes ashy whitish, faintly tinged with purple along the middle.

Intermediate valves (fig. 68) having *the tegmentum trilobate*, much narrowed in front by the encroachment of the girdle at the sutures; beaks small. Dorsal areas triangular, wide in front, *convex, polished, sculptured with elongated punctures along the sides.* Latero-pleural areas *sculptured with pebble-like low granules, coarser and often confluent along a diagonal line from the beak to the outer-anterior angle. Anterior valve* (fig. 67) *having 5 prominently projecting lobes*, corresponding to radiating rounded ribs; the scale-granules of the surface coalescing more or less on these ribs. Posterior valve (figs. 69, 70) having the tegmentum slightly broader than long, the mucro low, slightly post-median.

Interior light blue-green, fading on the sutural-laminæ. Sinus deep, angular. Anterior valve with 5, median valves 1 slit. Posterior valve having *a deep Mopaloid slit on each side, and about 4 shallower slits between, the teeth vertical, deeply grooved outside* and lobed at the edge.

Girdle wide, *leathery, smooth except for a minute pore at each suture* and 4 around the head valve; each pore bearing a small tuft of white spicules, usually broken short.

Length 50, breadth 23 mill.; divergence of tegmentum 140°.

Length 35, breadth 18 mill.; divergence of tegmentum 130°.

Length — breadth — (specimen rolled); divergence of tegmentum 150°.

New Zealand at Tasman Bay (Q. & G.); *Auckland* (Hutton, Wright); *Dunedin; Cook Strait* (Hutton.)

Chiton violaceus Q. & G., Voy. de l'Astrol. iii, p. 403, t. 73, f. 15–20.—GOULD., U. S. Expl. Exped Moll., p. 331, f. 420. Not *Chiton violaceus* REEVE, Conch. Icon., f. 41.—*Chiton porphyreticus* REEVE,

Conch. Icon., t. 10, f. 56 (April, 1847).—*Phacellopleura porphyretica* CPR. *MS.*

This species has a wide range of variation in coloring, in the angle of divergence of the valves, and to a less extent in the contours of the valves.

A. COSTATUS Adams & Angas. Pl. 3, fig. 74.

Shell elongated; valves carinated, angularly heart-shaped, granulated, pale brown. Lateral areas separated from the dorsal areas by a prominent rib; dorsal areas smooth and whitish in the middle.

Girdle beset with short, white, evanescent spicules, and having bunches of long white spicules.

Length 18, breadth 7 mill. (*A. & A.*)

Port Jackson, New South Wales, Australia.

Acanthochites costatus A. & A., P. Z. S. 1864, p. 194.—ANGAS, *l. c.* 1867, p. 224.—*Macandrellus costatus* DALL, Proc. U. S. Nat. Mus. i, p. 81, f. 40 (dentition).—*Chiton* (*Macandrellus*) *costatus* E. A. SMITH, Zool. Coll. 'Alert,' p. 83, t. 6, f. F.

Smith gives the following notes on the specimen collected by Coppinger: "The single specimen before me, preserved in spirit, shows the girdle to be of a pale buff color, thick, fleshy, the outer margin being delicately ciliated with a minute fringe of white spicules. The tufts of spicules are seven in number along each side, and four surrounding the front valve. The middle of the central valves is occupied by a raised, transversely substriated flattened ridge, on each side of which the surface is granulated or rather squamose, the scales being flat, imbricating, rather large, and disposed in rather regular series. The lateral areas are well defined by a raised keel. The front valve has five radiating costæ, and apparently the same number of slits in the thin lamina of insertion of which the three central are quite distinct and the two outer ones only feebly indicated. The single notch on each side the intermediate valves is also very slight. The posterior valve has a raised, somewhat excentric and pointed mucro, from which six more or less distinct radiating ridges descend to the margin, beneath which the lamina of insertion is scalloped by a similar number of notches."

A. TRIDACNA Rochebrune.

Shell ovate-elongate, white, shining. Anterior valve rounded, strongly 7-lirate radially, the liræ thick, rounded, scaly, elevated in front. Intermediate valves broadly triangular, the central areas

longitudinally striated at the apices, scaly at the sides; lateral areas bi-lirate, the liræ scaly. Posterior valve very small, nearly concealed, subquadrate, bi-lirate. Girdle wide, gray, pilose, clothed with whitish down; tufts 9, white, glassy.

Length 27, breadth 16 mill. (*Rochebr.*)

New Caledonia (Presented to the Paris Mus. by the Colonial Museum.)

Acanthochites tridacna ROCHEBR., in Bull. Soc. Philomathique de Paris, 1880–'81, p. 121.

This is evidently a form allied to *A. violaceus* and *A. costatus*. The *seven* anterior ribs mentioned evidently include the sutural margins, the number five being constant in this group.

Genus KATHARINA Gray, 1847.

Katharina GRAY, P. Z. S. 1847, p. 65. Type *C. tunicatus* Wood. —CPR. in DALL, Proc. U. S. Mus. 1878, p. 312.

Valves two-thirds covered by the expanded girdle, the exposed portion divided into dorsal and side areas, instead of central and lateral. Insertion plates sharp, extremely long, thrown forward; that of the head valve with 7–8 slits; sinus deep, spongy. Tail valve with a wide caudal emargination or sinus, and several slits, often partly obsolete, on each side. Girdle broad, smooth, poreless, leathery. Gills extending the whole length of the foot.

The poreless girdle, the long (ambient) gills, and the abnormally large number and irregularly placed slits of the head valve, all separate this well-founded genus from related groups. The irregularly placed anterior slits it shares with *Amicula* and *Cryptochiton*. The long gills are also a character of the last-named genus; but in the multifissate posterior insertion-plate and the naked girdle it resembles *Cryptoconchus* and *Loboplax*. There is but one species known.

K. TUNICATA Wood. Pl. 1, figs. 1–11.

Shell oblong, elevated, the valves mainly covered by the black, leathery girdle, a small cordate or flask-shaped area of a dark brown color, remaining exposed.

The exposed portion is about one-third the entire width of the valve; it is broad behind, and often hollowed out by erosion; narrowing in front like the neck of a flask. The surface when not eroded shows a distinct, smooth and shining dorsal band, the sides

(which are not divided into pleura and lateral areas) being microscopically densely punctate. Anterior valve (figs. 3, 4) densely punctate and having a few feeble radii. Posterior valve (figs. 8–11) small.

Interior white. Sutural plates enormously produced; the sinus very deep, squared and notched at the sides, exposing a projecting lobe of the extremely porous outer layer. Anterior valve having 7 or 8, central 1 slit, the insertion-plates extremely long, grooved outside from the short slits to the eaves. Posterior border of the black tegmentum broadly reflexed inward. Posterior valve (figs. 8–11) elevated, vertical behind, with a broad median notch or sinus and a variable number (1–4) of small slits on each side.

Girdle leathery, smooth, black.

Length 60–75, breadth 32–40 mill.

Length 50, breadth 20 mill.

Kamchatka; Aleutian Is.; on the north side of the peninsula of Alaska to Port Möller, on the south side east to Cook's Inlet and south to Catalina Island, California; low water (chiefly) to 20 fms.

Chiton tunicatus Wood, Gen. Conch., p. 11, t. 2, f. 1 (1815); Ind. Test., Chiton, t. 1, f. 10 (1828).—Sowerby, in Beechey's Voy., Zool. p. 15, t. 61, f. 15.—Reeve, Conch. Icon., f. 61.—*Chiton* (*Phœnochiton, Hamachiton, Platysemus*) *tunicatus* Midd., Mal. Ross. i, p. 98, t. 10, f. 1, 2.—*Katharina tunicata* Gray, P. Z. S. 1847, p. 69; Guide Syst. Dist., p. 185.—H. & A. Ad., Genera Rec. Moll. i, p. 479; iii, t. 54, f. 8.—Cpr., Suppl. Rep. Brit. Asso. 1863, p. 648. —Dall, Proc. U. S. Nat. Mus. 1878, p. 313.—*Katharina douglasiæ* Gray, P. Z. S. 1847, p. 69.

"This unmistakeable shell, characterized when fresh by its broad, shining black girdle and almost covered valves, is eaten raw by the natives of the northwest coast, and is said to act as an aphrodisiac" (*Dall*). The *K. douglasiæ* of Gray is founded upon a specimen dried with the girdle flatter and wider. It has no specific or varietal characters. The contour of the exposed portion of the valves, and the number of slits in the tail-valve, vary considerably. The soft parts are of a salmon color in the Northern specimens.

Genus AMICULA Gray, 1847.

Amicula Gray, P. Z. S. 1847, pp. 66, 69, 169; Guide, p. 187 (and earlier in Syn. contents Brit. Mus. 42d. edit., 1840, pp. 127, 153,

without diagnosis; no species mentioned). Type *C. vestitus* Sowb. —*Symmetrogephyrus* Midd., part, 1847.

Valves almost covered by the extention of the girdle over them, leaving only a small rounded or heart-shaped portion exposed at the apex of each; posterior borders of valves produced backward in rounded lobes at each side, the lobes completely separated by a posterior sinus having the tegmentum at its apex. Posterior valve having a posterior sinus and one slit on each side. Girdle more or less pilose, often having pore rows.

The essential features of *Amicula* are its small exposed portion or tegmentum, situated at the posterior edge, and not extending forward to the sinus, its Mopaloid posterior valve, short contour and short gills.

Dall has divided the genus into two subgenera thus:

Amicula Gray s. s. Gills median, type *A. vestita.*

Chlamydoconcha Dall. Gills ambient, type *A. amiculata.*

On account of the doubt attaching to the identity of *Ch. amiculatus* Pallas, we may well suspend judgment pending the receipt of fuller data.

The presence or absence of tuft-bearing pores is a very mutable feature and of no specific or varietal valve in *Amiula.* As the same has been shown to be true of *Mopalia* (*q. v.*) *Plaxiphora*, etc., it need occasion no surprise in this case.

A. vestita Sowerby. Pl. 8, figs. 23–26.

Oval, rather elevated, the valves nearly covered by a brown (or when young, yellow) skin continued upward from the girdle, but their outlines are plainly visible through this integument.

The small *exposed portion of each median valve is broadly heart-shaped*, and situated at the posterior margin of the valve; it is sculptured with strong concentric grooves and a more or less distinct granulation. There is no differentiation into areas. The exposed portion of the posterior valve is heart-shaped, with the mucro inconspicuous, near but slightly behind the middle.

Interior pure white. Anterior valve having 6–8 irregularly spaced and unequal slits; posterior valve having a deep sinus behind, and a single small mopaloid slit on each side. Jugal sinus rather small; sutural laminæ rather less projecting forward than the posterior rounded lobes on each side.

Girdle thin, smooth ; adults generally having more or less developed, but always sparsely scattered, small bunches of hairs.

Length 50, breadth 35 mill.

Arctic Ocean, extending southward in the Pacific region to Hagmeister and St. Paul Islands, Bering Sea; in the Atlantic to Cape Cod, Massachusetts, in 5–30 fms., mud and stones.

Chiton vestitus Brod. & Sowb., Zool. Journ. iv, p. 368 (1829); Conch. Illustr., f. 128, 128a; Zool. Beechey's Voy., p. 150, t. 41, f. 14.—*Amicula vestita* Gray, P. Z. S. 1847, pp. 65, 69, 169.—H. & A. Ad., Gen. Rec. Moll. i, p. 480; iii, t. 55, f. 2.—Stimp., Sh. of N. Engl., p. 29.—Cpr., Bull. Essex Inst. 1873, p. 155.—Dall, Proc. U. S. Nat. Mus. 1878, p. 307; p. 299, f. 43 (dentition).—*Chiton emersonii* Couthouy, Bost. Journ. Nat. Hist. ii, p. 83, t. 3, f. 10 (1838).—*Amicula emersonii* Gray, P. Z. S. 1847, p. 69.—Binney's edit. of Gould, Invertebrata of Mass., p. 264, f. 527.—*Chiton emersonianus* Gould, Inv. Mass., p. 151, f. 19.—Reeve, Conch. Icon., t. 11, f. 62.—*Stimpsoniella emersonii* Cpr., Bull. Essex Inst. 1873, p. 155; Ann. Mag. N. H. (4), xiii, p. 122 (1874).—*Chiton amiculatus* Reeve, Conch. Icon., t. 11, f. 59, not *C. amiculatus* Pallas.

The relations existing between *vestitus, emersonii* and *pallasii* have been clearly stated by Dall, who writes as follows: "Much has been said about the presence or absence of pores and hair-tufts. I find from examination of a series that the young *emersonii* is usually smooth, the large ones always setiferous. These setæ are, as described by Dr. Gould, in two rows on each side, or rather six in all if we count the pretty constant tufts behind the exposed apices of the shell. These rows are (1) two behind the shell points as above; (2) two, one on each side at the posterior angle of the submerged expansion of the valve; (3) a series, more or less irregular, along the margin of the girdle. Beside this, in old ones, there are irregular tufts all over the girdle, and some of the regular tufts may be missing."

"This species is very close to *A. pallasii*, but is distinguishable by the larger and laterally much more expanded exposed portions of the valves, by its flatter form, and proportionally sparser and longer setæ. When dry, the whole form of the valves is visible in *vestita* from above, like the bones of a Peruvian mummy; in *pallasii*, however, the integument is so much more coriaceous and thick, that in dry specimens hardly anything of these outlines is visible."

The locality given by Sowerby for *Ch. vestitus* is "Arctic Ocean"; but from our knowledge of Beechey's voyage it must have been collected on the American shore, north or north-east of Bering Strait.

Var. ALTIOR Carpenter.

Shell similar to *emersonii*, but much longer, narrower, higher; the exposed part larger in proportion to the size of the valves, and wider, trilobate on the central valves and conspicuously rugose-granulate, hardly lirate around the margins. Inside normal; posterior valve unknown; central valves with 1, anterior 8 short slits, with delicate grooves extending to the eaves.

Length of a central valve 7½, breadth 3¾ mill.; divergence 90°. (*Cpr.*)

Pleistocene Drift, Lower Canada (Mus. Dawson.)

Only one anterior and two central valves have been found of this. On a careful comparison with the corresponding valves of the living species, it appears that the shape more resembles *Cryptoconchus*; that the exposed part was nearly as large (in the head-valve decidedly larger) as in a specimen of *emersonii* nearly double its breadth, and that the ribbed frame-work of the shield was wanting. (*Cpr.*)

A. PALLASII Middendorff. Pl. 5, figs. 1–11.

Shell nearly concealed by the girdle, a somewhat heart-shaped tegmentum only being visible at the apex of each valve; elevated at an angle of 98°–110° in the young, 120° in large adults; oval, elongated. Valves white, smooth, fragile, the tegmentum cordiform, posterior. Slits in anterior valve 6–8, posterior valve 2.

Girdle roundly covering the entire back of the animal, except for 8 small rounded holes along the median line; color dingy buff; dorsal surface bearing all over unequal bunches of reddish hairs, appearing to be sparser in the young. Branchiæ extending forward two-thirds the length of the foot.

Length 67, breadth 48, alt. 21 mill.

Okhotosk Sea (Midd.); *Pribiloff, Aleutian and Shumagin Is.* (Dall), in 3–10 fms.

Chiton pallasii MIDD., Bull. de la Classe physico-mathém. de l'Acad. de St. Pétersb., vi, p. 117 (1847).—*Chiton* (*Phœnochiton, Dichachiton, Symmetrogephyrus*) *pallasii* MIDD., in Middendorff's Reise in den äussersten norden und osten Siberiens, ii, Zool. pt. 1, p.

163, t. 13, f. 1–9; t. 14, f. 1–6; Mal. Rossica i, p. 98.—*Amicula pallasii* H. & A. Ad., Gen. Rec. Moll. i, p. 481.—Chenu, Manuel, i, p. 383.—Dall, Proc. U. S. Nat. Mus. 1878, p. 309.—*Stimpsoniella pallasii* Cpr., Bull. Essex Inst. 1873, p. 155.

Although closely allied to *A. vestita*, this species differs in the more hairy, thicker girdle, the less exposed tips of the valves, which are smaller and less transverse. The figures do not represent dried specimens. The description is from Middendorff.

A. AMICULATA Pallas. Pl. 5, figs. 15, 16.

This species was described by Pallas from a dried specimen measuring 4 inches in length. Figures 15, 16, are copied from his plate. The following note contains all that is useful in his description: Valves covered with cartilage, scabrous and subverrucose outside, the part surrounding the valves being thick, harsh, cartilaginous. The 8 valves are white and very fragile, the first being nearly horse-hoof shaped, crenulated on the front margin; the intermediate valves are shaped as if made of two circular disks, and have a transverse obsolete swelling above. The first 7 valves have a pentagonal sharply margined piece (tegmentum), truncated behind, at the angle of the posterior sinus. The 8th valve is angular, as if formed of two pentagons, excavated behind.

Pallas' figures of the upper surface (26, 27) do not differ from that of *A. emersonii* except that the exposed portions of the valves are smaller and of a different shape. His figure of the ventral surface (28) shows the gills to extend from the top of the head completely along both sides and uninterruptedly around the tail! There can be no reasonable question that this is a mistake in the drawing, just as the omission of lateral slits in the intermediate valves is. The gills are probably short, as in *vestita* and *pallasii*.

Kuril Is. (Pallas.)

Chiton amiculatus Pallas, Nova Acta Acad. Sci. Imp. Petropolitanæ, ii, p. 235, t. 7, f. 26–30 (1786).—Gmel., Syst. Nat. xiii, p. 3206.—Wood, Gen. Conch. p. 13.—Midd., Mal. Ross. i, p. 96.

Not *C. amiculatus* Sowb., Conch. Illustr., f. 80, nor of Gray, P. Z. S. 1847, pp. 65, 69, 169=*P. stelleri* Midd. Not *C. amiculatus* Wood, Index, Test., f. 12, nor of Reeve, Conch. Icon., f. 59=*A. vestita* Sow.

? *Chamydochiton amiculatus* Dall, Proc. U. S. Nat. Mus. 1878, pp. 1, 310.

? *Chiton pallasii* MIDD., see below.

It would be a distinct advantage to science if the attempt to identify *Chiton amiculatus* could be given up. The figures of Pallas indicate a species externally very similar to *A. vestita* in the dry condition, except that the exposed portion of the valves, and as far as known their entire structure, accords completely with that of *A. pallasii* Midd. There is not much doubt in my mind that the *A. pallasii* really is the same as the original *amiculatus*, notwithstanding its apparently thicker and more hairy integument.

Carpenter identified as *amiculatus* a form collected by Dr. Newcomb on the Farallones Is., off San Francisco Bay. He describes it as follows:

"*Amicula amiculata* (? Pallas). Pl. 5, figs. 12, (13, 14?).

Shell externally resembling a young *C. stelleri*, but the apices of the valves are present and rounded; inside the insertion plate of the posterior valve is Mopaloid, having one slit on each side, like the intermediate valves; the caudal sinus is wide and deep. The anterior valve has . . . . ? slits. The anterior sutural-laminæ of each valve are moderately connected across the broad sinus; the posterior sutural-laminæ are larger, regularly arcuate, hardly sinuated outwardly, having a broad deep sinus behind, flat behind the apex and hardly laminated. Slits grooved up to the apices. Girdle coriaceous, smoothish, with two series of larger pores at sutures and margin, and series of smaller pores placed between the valves and irregularly, sparsely scattered over the girdle; setæ of the pores few, long, hardly spicular."

"The shell here described must have been about 3 inches long when living, and rather more than half the breadth. It accords sufficiently nearly with the very brief description of *Ch. vestitus* Brod. & Sby. in the Zoological Journal, but not with the figure of the specimen there described in Conchological Illustrations. Moreover the gills of *Ch. vestitus* are median, of this (as far as I can judge from the dried remains) ambient, which is the character of *Ch. amiculatus, teste* Midd. It was sent by Dr. Newcomb to Dr. Gould as the young of *Ch. amiculata* Sby. (=*stelleri*); from which it differs (1) in the round mucro, which represents in fact the jugular, central and side areas squeezed up into a knob which alone projects at the posterior part of each of the 7 anterior, and the middle of the hind valve; (2) in the posterior sutural laminæ being a curved continuation behind of the side laminæ not separated by waves at the sides, but separated

by a deep posterior sinus reaching the external knob; (3) in the long hairs of the bunches which are disposed in regular pores along the margin and across the sutures, as well as irregularly over the surface."

Middendorff had never seen specimens of *amiculatus*, his information being derived wholly from Pallas' description and figures.

Dall has given Carpenter's description in his paper on the Chitons of the north-west coast (Proc. U. S. Nat. Mus. 1878, p. 310), and proposes the name *Chlamydochiton* for the species, on account of its ambient gills. See also under *Cryptochiton stelleri*.

Subfamily CRYPTOCHITONINÆ.

Genus CRYPTOCHITON Middendorff & Gray, 1847.

Cryptochiton MIDD., Bulletin de la Classe Phys.-math. de l'Acad. des Sci. de St. Pétersb. vii, no. 8, p. 116 (separate copies distributed in Spring of 1847); Beiträge zur einer Malacozoologia Rossica, i, p. 33.—*Cryptochiton* GRAY, Ann. Mag. Nat. Hist. xx, pp. 70, 134 (July and August, 1847); P. Z. S. Lond. 1847, pp. 65, 69, 169.

Valves entirely concealed in the leathery girdle, and lacking tegmentum; their posterior margins produced backward in a deep lobe on each side, the lobes united across the median line, causing the apices of all valves to be removed inward from the posterior edge. Slits subobsolete or lacking in the intermediate valves. Girdle covered with minute tufts of short bristles. Gills extending the entire length of the foot.

This genus differs from *Amicula*, and from all other known Chitons, in the union of the posterior lobes of the valves across the median line, causing the apices of the median and anterior valves to be placed subcentrally or at the posterior third, instead of at the posterior margin.

C. STELLERI Middendorff. Pl. 7, figs. 7–13; pl. 6, fig. 6.

Oblong, rather depressed, the bilobed posterior outlines of the valves (in dry specimens) showing through the leathery integument, which completely covers the valves. Color a dull ferruginous or brick-red, very well preserved specimens being rendered much brighter by the closely placed fascicles of brilliant vermilion spines.

The valves are wholly concealed, white or flesh-colored, entirely lacking the outer colored layer (tegmentum) of other Chitons; their edges are more or less thinned and crenulated by radial striæ. Anterior valve (figs. 8, 9) having the apex at the posterior third, and with 4 to 7 slits. Intermediate valves (figs. 12, 13) having the apex near the posterior third; formed of two large anterior lobes expanded at the sides, and two smaller, narrow posterior lobes. Posterior valve (figs. 10, 11) having the mucro posterior or near the posterior third; deeply sinused in the rear, and usually having a slit on each side of the sinus.

Girdle leathery, thick, red, densely covered with countless minute fascicles of vermilion spinelets (pl. 6, fig. 6.)

Length 15 to over 20 cm.

Endermo Harbor, south of Jesso, Japan; *Sakalin Island; Kuril Is.; southern extremity of Kamchatka*; *Aleutian Is.*; *Alaska and the whole American coast southward to Monterey and the Santa Barbara Is.;* just below tide mark.

Chiton stelleri MIDD., Bull. Acad. Sci. St. Pétersb. vi, p. 116 (1846).—*Chiton* (*Cryptochiton*) *stelleri* MIDD., Mal. Ross. i, p. 93, t. 1–9; Mem. de l'Acad. Imp. Sci. St. Pétersb., 6me Sèr., vi, p. 101, 157, 1849 (full account of anatomy).—SCHRENCK, Amurl. Moll., p. 271.—*Cryptochiton stelleri* GRAY, Guide Syst. Dist. Moll. B. M., p. 185 (1857).—H. & A. AD., Gen. Rec. Moll. i, p. 479; iii, t. 55, f. 1.—CPR., Suppl. Rep., etc., Brit. Asso. 1863, p. 648.—GABB., Palæontol. Cal. ii, p. 87.—DKR., Ind. Moll. Mar. Jap., p. 159.—SMITH, Ann. Mag. N. H. 1875, xvi, p. 115.—DALL, Proc. U. S. Nat. Mus. 1878, p. 311; p. 299, t. v, f. 44 (dentition).—*Cryptochiton stelleri* var. *violacea* NORDMANN, Bull. Soc. Imp. des Naturalistes de Moscou, xxxv, 1862, p. 329, t. iv.—*Chiton amiculatus* SOWB., Conch. Illustr., f. 80, 80bis., and GRAY, P. Z. S. 1847, pp. 65, 69, 169. NOT of Pallas.—*Chiton sitkensis* REEVE, Conch. Icon., Chiton, t. 10, f. 55; t. 11, f. 55b (1847); not *C. sitkensis* Midd.—*Chiton chlamys* REEVE, *l. c.*, t. 11, f. 60.—*Chiton californicus* PRESCOTT, Amer. Journ. Sci. and Arts (2), xxxviii, p. 185, fig. in text. (Sept., 1864). —?? *Chiton giganteus Kamtschaticus* TILESIUS, Mém. de l 'Acad. St. Pétersb. ix, 1824, p. 473, t. 16, f. 1, 2; t. 17, f. 3–8 (in part).—*Cryptochiton asmus* in the Dorpat Collection, teste Midd., Mal. Ross i, p. 40.

The foot and softer parts of this species are eaten raw by the Aleuts and Indians.

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Occasional individuals are variegated with gray-white or pinkish patches, the specimen figured being one so marked, received from Mr. Newcomb, of the Provincial Museum, Victoria, British Columbia. The valves of this specimen are of a beautiful pink color inside. The largest specimen I have seen is in the collection of Mr. John Ford; if straightened out it would measure over 8½ inches in length. Some other specimens before me are yellow on the back, but a minute examination shows that they have lost the red bunches of minute bristles.

The number of slits, and even their presence varies greatly. Valves ii and vii are usually provided with slits, but the other intermediate valves lack them. The posterior valve generally has slits, even in individuals quite adult; but sometimes they are obsolete, being filled in by an excessive thickening of the posterior edge of the valve. The mucro of each valve is in most cases quite inconspicuous, but on some valves of occasional specimens it is raised in a minute point, or marked by a puncture; in either case being still covered by the general integument.

It is by no means certain whether any true varieties or geographic races exist; but the following may be accepted provisionally.

Var. VIOLACEUS Nordmann. Pl. 6, figs. 1–5. (Living specimen.)

Beautiful violet colored when living, fading in alcohol to a dark brick-red, with large rounded light gray spots. A dried individual is dirty gray-reddish above. Largest specimen measures along the convex back 152 mill.; the smaller individual figured measures 90 by 63 mill.

Sachalin I.

The colors of the living animal are thus described by Arthur Nordmann: Cryptochiton stelleri varies much in its coloration; in some examples the ground-color of the convex back is clear brownish-red; in others yellowish-red; in still others, but rarer, beautiful dark violet with lighter streaks undulatingly passing outward from the median line, and indicating the number of valves. * * * The under side is dirty yellowish, the foot sometimes butter-yellow, the long, narrow girdle of gills (consisting of 140–150 leaflets) being reddish.

Var. APICALIS Pilsbry.

All characters as in *C. stelleri* except that the apices of the valves are distinctly projecting as small circular elevations; substance of

valves pinkish. Length of valves, measured around back of a curled specimen 117, breadth of widest valve 31½ mill.

Japan (no. 61399 U. S. Nat. Mus.)

Family CRYPTOPLACIDÆ Dall.

Elongated or vermiform Chitons, having proportionally small valves; tegmentum of each valve (except the first) divided into two latero-pleural areas and a dorsal area. Insertion and sutural plates strongly drawn forward, sharp, smooth, the anterior valve with 3–5 slits, the other valves with one slit on each side or none. Posterior valve having the mucro far posterior, insertion plate continuous behind, not sinused nor slit there. Girdle very thick and wide, spiculose, generally with small sutural tufts and four around the head valve. Gills occupying the posterior third of the parapodial grooves.

This family is evidently a comparatively modern branch from the Acanthochitoid stock, differing in the degeneration of the valves in size, consequent upon the adoption of a life in burrows and holes. The number of slits is greatly reduced; and the insertion-plate of the tail-valve has no sinus or upward wave behind. The short gill-row is an inheritance from the *Acanthochitidæ*, which in turn inherited this feature from the low Ischnoid or high Lepidopleuroid stock from which they sprung; short, posterior gills being characteristic of the lowest Chiton stocks, as well as of the *Aplacophora*.

The zoological rank of the *Cryptoplacidæ* has been ably discussed by Haddon (Challenger Polyplacophora p. 46, 47), who concludes that "the genus *Cryptoplax* is a highly specialized branch of a low group of Chitons." To this it should be added that the specialization has been in the direction of degeneration; the gills are shorter than in the parent stock *Acanthochitidæ;* the foot and valves are notably reduced in size and functional capacity, and the nervous system shows unmistakeable traces of reversion.

Two genera, not very diverse in characters, are distinguishable:

CRYPTOPLAX Blainv., in which the body is vermiform, the anterior valve having 3 slits, the others none; valves disjointed or merely touching.

CHONEPLAX Cpr., more like an ordinary Chiton, but much elongated, the valves all strongly overlapping or imbricating.

Genus CRYPTOPLAX Blainville, 1818.

Cryptoplax Blainv., Dict. des Sci. Nat. xii, p. 124, for *C. larviformis* and *depressus*.—*Chitonellus* Lamarck, An. sans Vert. vi, p. 317, for *C. lævis* and *striatus* (1819.)—*Ametrogephyrus* Midd., Mal. Ross. i, p. 33, (1847).

Much elongated, distinctly vermiform, the valves not nearly covering the entire dorsal surface, the posterior ones either separated from one another or in contact merely at their tips. Insertion and sutural plates very strongly drawn forward, the anterior valve having three slits, the other valves none. Girdle minutely setose, generally having minute sutural pore-tufts. Gills occupying the posterior third of the branchial groove.

Distribution, Philippines to Tasmania and Polynesia.

In this genus the sutural-laminæ of each valve are entirely separated from the valve next forward, although they are deeply inserted in the muscular integument of the back. The number of slits is more reduced than in any other forms having insertion-plates, approaching in this respect the *Lepidopleuridæ*.

Only four species of this genus are recognized by Haddon, in his revision of the genus in the Report on the Polyplacophora collected by the Challenger Expedition. They may be recognized by these marks:

C. striatus Lam. Large or medium sized, convex above, flat below, the valves all in contact or nearly so, conspicuously wrinkle-sulcate at the sides, with a smooth dorsal band. Pores present or absent, the girdle densely spiculose, without a ventral bounding fringe.

C. burrowi Sm. Small; valves iv, v, vi and vii very small and very widely separated from one another; grooved at the sides, with smooth central bands. Pores minute.

C. oculatus Q. & G. Smaller, having the latter four valves separated, longitudinally grooved at the sides, having triangular smooth dorsal areas. Pores wanting. Several front valves surrounded with fringes of black and of white bristles.

C. larvæformis Blv. Large, cyclindrical, having the latter four valves widely separated, sculptured with grooves converging forward to a dorsal sulcus, sometimes ill-defined. Minute pore-bunches generally present; having a fringe of spicules bounding the ventral surface. Anterior several valves eroded, not surrounded with black and white fringes of spicules.

C. STRIATUS Lamarck. Pl. 9, figs. 11, 12, 13, 14, 15; pl. 11, figs. 37–39.

Elongated, vermiform, very *convex above, flat below*; hoary gray maculated with rust-brown; when dry, dull reddish-brown. *The valves are in contact with one another*, or the posterior four may be separated by short intervals, always *much shorter than the valves.*

Anterior valve having the tegmentum longer than wide, more than twice as long as the anterior teeth; its surface cut into a coarse, irregular granulation by peculiar zigzag impressions [very badly rendered in pl. 9, fig. 11]. Median valves (fig. 13) sagittate, widest at about the posterior third, tapering forward; sculptured with several deep, finely and irregularly zigzag grooves at the sides (sometimes transformed into a pattern of v-shaped granules); the dorsal area narrow, raised, smooth except for slight growth lines. Posterior valve (fig. 14) like the median valves externally, but having a short vertical granulose slope below the mucro.

Interior light olive-green, generally becoming pink on the sutural-laminæ and teeth. Anterior valve having 3 slits, other valves none; posterior valve having the insertion-plate continuous, but somewhat emarginate behind.

Girdle wide, fleshy, densely covered with minute calcareous spinelets, and in most good specimens showing minute pores at some or all of the sutures, and four around the head-valve.

Length 55, breadth 12 mill. (average dry specimen.)

Length 61, breadth 22 mill. (alcoholic specimen.)

Chitonellus striatus LAM., An. s. Vert. vi, p. 317, 1819.—DESH. in Lam. vii, p. 481, 1836.—SOWB., Genera of Shells t. 139, f. 4; Conch. Illustr., f. 62.—BLAINV., Dict. Sc. Nat. xxxvi, p. 551, 1825.—REEVE, Conch. Syst. ii, t. 135, f. 1; Conch. Icon., f. 4.—*Chitonellus gunnii* RVE., Conch. Icon., f. 5, 1847.—*Ch. rostratus* RVE., *l. c.*, f. 6. *Ch. oculatus* RVE., *l. c.*, f. 7*a*, *b* (not of Q. & G.).—*Cryptoplax striata* +*gunni*+*rostrata* H. & A. ADAMS, Gen. Rec. Moll. i, p. 484.—ANGAS, P. Z. S. 1867, p. 224, 225.—*Chiton* (*Chitonellus*) *striatus* SMITH, Zool. Coll. 'Alert,' p. 84.—*Cryptoplax striatus* HADDON, Chall. Rep. xv, p. 39, t. 1, f. 9; t. 3, f. 9*a*–9*m*.

Raines Island, Torres Straits (Reeve, for C. rostratus and C. striatus), *Port Lincoln* (J. B. Harvey), *Newcastle* (Dr. Dieffenbach), *Port Jackson* (Coppinger, Richardson, Jukes, King), *Flinders Island* (J. Milligan); *Tasmania* (Reeve, C. gunnii); *Tasmania* (Macgillivray and Gunn).

In one (alcoholic) specimen before me, figured on pl. 11, figs. 37, 38, 39, pores are completely absent. Figure 37 represents a portion drawn from the edge of the ventral surface, which, though minutely roughened is not spiculose. The figure is magnified 25 diameters.

Var. GUNNII Rve. Pl. 8. fig. 14.

"The variety *gunnii*, from South Australia and Tasmania, may be recognized by the valves being narrower, with the exception of the first two. This form also appears to attain a larger size than specimens from New South Wales and other localities further north. A specimen in spirit, from the mouth of the river Tamar, Tasmania, presented to the British Museum by J. Macgillivray, exceeds four inches in length. The mantle of the southern form also appears to be rather less densely covered with the minute conical spines. The number of gills on each side varies with age, and even in individual specimens I have found 30 or 31 on each side in specimens of equal size from both regions—that is, north and south; and in the largest specimen before referred to there are 27 on the right side and 34 on the left, and there is no appearance of any having been removed." (*Smith.*)

C. BURROWI Smith. Pl. 9, figs. 6, 7, 8, 9, 10.

This curious species is known by the small size of the valves, the remoteness from one another of the fourth, fifth and sixth, and the excessively short and densely packed spines on the mantle. The single specimen in spirit, from Port Molle, is of a buff color, copiously mottled with green: this accords with a specimen (also in spirit) mentioned by Reeve, collected by Capt Belcher in the Straits of Macassar. The dried specimens are greyish, more or less rose-tinted. The sculpture of the valves is very like that of *C. striatus*, consisting of a central smoothish ridge, with two or three finer and more or less wrinkled ones on each side, the front valve of course being wrinkled throughout and lacking the central smooth ridge. They are yellowish at the mucro or posteriorly, and pinkish red in front. The plates of insertion are like those of *C. striatus*, and of a pale greenish color. (*Smith.*)

Chitonellus burrowi has pores, and is therefore a *Cryptoplax*. There is no trace of them externally, and they are only discernible by removing the outer scaly coat; they are then seen (but not distinctly as in the other species) upon the white skin beneath in just

the same position and to the same numbers as in *Cryptoplax larvæformis* and *Cryptoplax striatus*. (*Haddon.*)

Port Adelaide (Rve.) *and Port Molle* (Coppinger); *Straits of Macassar* (Belcher.)

Chitonellus larvæformis Reeve, (not of Burrow or Blainv.), Conch. Icon., f. 3, 1847.—*Chiton* (*Chitonellus*) *burrowi* Smith, Zool. Coll. H. M. S. 'Alert,' p. 85, 1884.—*Cryptoplax burrowi* Haddon, 'Challenger' Polyplac., p. 42, t. 3, f. 11*a*–11*m*.

The gill-rows are very short, occupying less than a third the total length, and there are 22 branchiæ on each side.

C. oculatus Quoy & Gaimard. Pl. 9, figs. 1, 2, 3, 4, 5.

A chiton with the body small, equally hairy, roseate, and encircled with two black bands; valves glaucous, longitudinally furrowed, the front three ovate, encircled by black and white hairs.

A small species which is separated from *C. fasciatus*, as well as from the two indicated by Lamarck, by its less cyclindrical form, less obtuse extremities and greater flatness; by having the body covered with longer bristles and more crowded than in the above-mentioned species; finally it differs in having the anterior three valves oval, sea-green, *surrounded by a circle of black bristles and another, outside of that, of white ones;* giving the appearance of eyes to these valves. The other valves are narrower, separated, claw-shaped, and red-brown colored. All except the first are *parallel-grooved longitudinally, with a smooth triangle in the middle.*

It is probable that the plates of insertion are the same as in *Ch. fasciatus*, but we have not examined them in the single individual in our possession. The color is reddish, with two black transverse bands, confluent on the back. The ventral surface is yellowish. The mouth is encircled by a oval, fringed veil. The branchiæ occupy a little less than the posterior third of the body; there are 20 lamellæ on each side.

Length 2 inches, 6 lines; circumference 1 inch, 5 lines. (*Q. & G.*)

? New Guinea or Vanikoro (Q. & G.); *Samboangan, Philippines* in 10 fms. (Challenger); *Friendly Is.* (Brit. Mus. Coll.)

Chiton oculatus Q. & G., Voy. Astrol., Zool. iii, p. 410, t. 73, f. 37, 38, (1834).—*Chitonellus oculatus* Dh. in Lam. An. s. Vert., vii, p. 482 (1836).—*Cryptoplax oculatus* Haddon, Challenger Polyplac. p. 41, t. 1, f. 10; t. 3, f, 10a–10m.—*Chitonellus fasciatus* Reeve,

Conch. Syst. ii, t. 135, f. 5 (only).—? *Chitonellus lævis* LAM. Not *Chitonellus oculatus* REEVE, Conch. Icon., f. 7a, 7b.= *C. striatus.*

This species is peculiar in the circles of black and white bristles surrounding the anterior valves. The well-defined dorsal smooth areas, and the apparent lack of pores. These characters readily separate it from *C. larvæformis*, a species otherwise rather similar. It should be noted however, that some individuals of *larvæformis* lack pores.

C. LARVÆFORMIS (Blainv.) Burrow. Pl. 11, figs. 31–36, 40–43.

Cylindrical and vermiform, wider posteriorly. Color pale buff, clouded and maculated with reddish, and having two or several transverse bands and a median dorsal line of the same; the ventral surface of a uniform pale tint, *separated from the lateral and dorsal integument by a distinct line of longer white spicules.* The first four valves are in contact and eroded, *the hinder four are widely separated*, the greatest space being between valves vi and vii.

Anterior valve having the tegmentum about twice as long as the anterior teeth, much eroded, the worn portion generally pink and dull white (the pink sometimes replaced by olive); the unworn outer rim smooth except for growth-lines, and usually reddish. Tegmentum of second valve somewhat pentagonal, broadest in front of the middle, eroded. The other median valves are sagittate, the posterior 3 or 4 being generally but little eroded, and showing a *sculpture of coarse, uneven longitudinal furrows, converging forward toward a dorsal sulcus.* Posterior valve (figs. 42, 43) having the mucro produced far backward; cavity shallow.

Interior of valves white, generally marked with pink in each valve, but sometimes suffused with pale green. Anterior valve with three slits, other valves having none.

Girdle clothed with minute calcareous spicules, mostly red in color, but white on the light patches; the spicules very short on the anterior part of the body, with some longer ones intermingled, longer on the posterior part (pl. 11, fig. 33). On the ventral surface the spicules are extremely short and blunt; and *at the junction of base and sides there is a crowded row of white spinelets* (fig. 32). At each suture there is a minute bunch of white spinelets (fig. 34), and around the head-valve four such pore-bunches are found. In some specimens some of the posterior pores are absent, and others lack all pores.

Length 105, breadth 24, thickness 19 mill. (alcoholic specimen.)

Viti Islands (A. Garrett!); *Tonga Tabu, Friendly Is.* (Q. & G.); *Kandavu, Fiji,* (Challenger Exped.), *Dalaquete, Zebu, Philippines* (Cuming.)

Cryptoconchus larvæformis Blv. in Burrow, Elem. of Conch. p. 190, 1815 (no description).—*Chiton larvæformis* Burrow, *l. c.*, p. 191, t. 28, f. 2, 3, 4.—Blainv., Manuel de Mal., p. 603, t. 87, f. 6, 1825.—*Cryptoplax larvæformis* Haddon, Challenger Polyplac., p. 37, t. 3, f. 12.—*Cryptoplax larvæformis* Blv., Dict. Sci. Nat. xii, p. 124, 1818.—Ads., Gen. Rec. Moll. i, p. 484.—*Chiton chitonellus* Blainv., Dict. Sci. Nat. xxxvi, p. 550.—*Chiton vermiformis* Blainv., *l. c.*, p. 553.—*Chiton fasciatus* Quoy & Gaimard, Voy. de l'Astrol., Zool. iii, p. 408, t. 73, figs. 21–29.—*Chitonellus fasciatus* Desh. in Lam., An. s. Vert. vii, p. 482.—Reeve, Conch. Syst., t. 135, f. 3, 4; Conch. Icon., f. 2.—Gould, U. S. Expl. Exped., p. 333, atlas, t. 28, f. 429.—*Cryptoplax fasciata* Ads., Genera, t. 55, f. 6, 6a.—*Chitonellus lævis* Reeve, Conch. Syst. ii, t. 135, f. 2.—*Chiton eruciformis* Sowb. Gen. Shells, t. 139, f. 5 (1820–1825.)

Readily distinguished from *C. burrowi* by the form of the posterior valve and the absence of a raised smooth dorsal band on the valves. This latter feature seems to separate it also from *C. oculatus*, in which, besides, the longitudinal grooves on the sides of the valves do not converge forward. There is also a difference in the profile of the tail-valve, in the spicules surrounding the anterior valves, and in the size.

On plate 11, fig. 31, 40–43, represent the largest specimen before me. It was collected by Garrett at the Viti Is. Figures 32–34 were also drawn from this specimen, fig. 34 representing a single pore-bunch; fig. 33 a square mill. from near the posterior valve, and fig. 32 a portion of the marginal row of spinelets showing the minute spicules of the base below, the dark-colored spicules of the side of the animal above. This example shows the 18 minute bunches of white spinelets characteristic of the species, although the posterior ones are very minute. Another specimen (fig. 35) is somewhat differently marked, and lacks all pores or pore-bunches. As this example is excellently preserved in spirit, and not wrinkled, the absolute absence of pores can be affirmed with confidence. I can see no differences in the valves between this example and the Viti Island specimens. Part of the dried specimens before me seem to lack pore-bunches, but this cannot be determined with certainty.

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Haddon found the posterior pair of tufts wanting in one of the specimens collected by the Challenger. He further remarks: "The only conclusion at which we can arrive in this species is that normally nine pairs of tufts are present, but that in some specimens more or fewer of the posterior pairs may be absent. This further leads us to the supposition that they may be entirely absent, although we have at the present time no direct evidence in support of the last alternative."

False and insufficiently defined Cryptoplaces.

The following descriptions are of course worthless for purposes of identification. They are introduced here simply to save students the trouble of looking them up in the original publication. No information other than that here given has been published.

Cryptoplax montanoi Rochebrune. Corpus ovoideum, crassum, antice rotundatum, intense villosum, aurantiaco fulvum, fasciis nigris luteo marginatis, cinctum; valvis medianibus minutis, rostratis lateraliter striatulatis; area centralis subsquamosa, squamis rectis, acutis; valvis anticis rotundatis, rugosissimis. Ligamento marginis, pilis brevissimus obsito. Long. 0,045; lat. 0,016.(*Rochebrune*, Bull. Soc. Philom. Paris, 1881–'82, p. 190.)

Borneo; Lucon (Drs. Montano and Rey). Rare. Paris Mus.

This is probably a synonym of *C. striatus.*

Cryptoplax peroni Rochebrune. Corpus angustum, antice rotundatum, rugosum, violaceum, fasciis albidis passim cinctum; valva antica subtriangularis; valvis centralibus ovatis, elevatis, radiatim sulcatis, postica lata. Long. 0,022; lat. 0,007. (*Rochebr.*, Bull. Soc. Philom. 1881–'82, p. 193.)

New Holland (Peron and Lesueur). Rare. Paris Mus.

Cryptoplax torresianus Rochebrune. Corpus elongatum, antice posticæque rotundatum, pilosissimum, luteo rufum, valva antica rotundata, subfodiata, valvæ centrales elongatæ, intense umbonatæ, antice macula nigra pictæ; areis lateralibus longitudinaliter granulose striatis, granulis squamiformibus; valva postica umbonata, umbone prealto, conico, obtusissimo. Long. 0,060; lat. 0,004. (*Rochebr.*, Bull. Soc. Philom. Paris, 1881–'82, p. 195.)

Torres Straits. Rare. Paris Mus.

Cryptoplax caledonicus Rochebrune. Corpus elongatum, insuper spinossimum, antice acuminatum, postice rotundatum, luteolum,

maculis cæruleis marmoratum; valva antica elliptica rugosa; valvarum intermediarum area centralis angusta, rotundata, squamis imbricatis sculpta; areis lateralibus, sulcis divaricatis, rugosis, ornatis. Ligamento marginis fimbriato. Long. 0,040; lat. 0,008. (*Rochebr.*, Bull. Soc. Philom. 1881–'82, p. 196.)

Kouë, New Caledonia (MM. Beaudoin and Heurtel). Not common. Paris Mus.

Cryptoplax heurteli Rochebrune. Corpus ovatum, villosum, antice posticeque rotundatum; luteo roseum fasciis 2 latis, rubris cinctum; valva antica rotundata, lævis; valvis centralibus viridescentibus, minutissimis, areis medianis lævibus, lateralibus longitudinaliter striatis, striis denticulatis. Ligamento marginis, setis longis vestito. Long. 0,028; lat. 0,009. (*Rochebr.*, Bull. Soc. Philom. 1881–'82, p. 196.)

New Caledonia (M. Heurtel); Rare; Mus. Paris.

Cryptoplax unciniferus Rochebrune. Corpus elongatum, antice attenuatum, postice latum, glaberrimum, luteofuscum; valvis cæruleis, antice subquadrata, postice intense umbonate, umbone acuto; ceteris angustis, unciniferis; area centrales minute punctata; lateralibus circulariter sulcatis sulcis imbricatis, nodosis. Long. 0,068; lat. 0,010. (*Rochebr.*). Bull. Soc. Philom. 1881–'82, p. 197.

New Caledonia (Museum of the Colonies; M. Heurtel). Common. Paris Mus.

Genus CHONEPLAX Carpenter, 1882.

Choneplax Cpr. in Dall, Proc. U. S. Nat. Mus. 1881, no. 49, p. 285, 288 (Jan. 20, 1882). Type *C. strigatus* Sowb.—*Chitoniscus* Cpr. (part) *l. c.*, no. 49*a*, p. 285, 288. Types "*Chitonellus striatus* and *strigatus* Sowerby, Conch. Ill., figs. 62 and 63."

Much elongated, somewhat vermiform. Valves subequal in size and all strongly overlapping, the mucro of the tail valve projecting far backward. Insertion and sutural plates all strongly drawn forward, the anterior valve with 3–5 shallow slits, the other valves having one slit on each side or none. Girdle minutely setose, and having sutural tufts, sometimes obsolete. Gills posterior.

Distribution, West Indies.

This genus, whilst closely allied to *Cryptoplax*, differs in the strong imbrication of all the valves, and their much greater comparative

size. The slits of the insertion-plates are less obsolete than in *Cryptoplax*.

C. LATUS Guilding. Pl. 8, fig. 15.

Elongated, narrow, vermiform; the valves strongly imbricating, eroded, generally dirty white with a dull brown median band or area, the unworn side margins brown. Interior of valves bluish or gray, generally black in the cavity.

The intermediate valves are squarish, very blunt behind, and when unworn are minutely granulated at the sides, with an indistinctly defined dorsal smooth band. Posterior valve smaller, with posterior mucro.

Interior dark colored, the median valves having the sinus very narrow, deep and square. Anterior valve having 3 slits, other valves none. Posterior valve having a long sharp insertion plate, directed forward; much hollowed out.

Girdle wide, brownish, covered with minute spicules, having a fringe of longer white spinelets around the border of the ventral surface, and provided with 9 small tufts of brown spinelets on each side.

Length about 25 mill.

St. Thomas and Guadaloupe (R. Swift! in Coll. Phila. Acad.); *St. Vincent* (Guilding!); *Portorico* (Blauner!).

Chitonellus latus GUILDING, Zool. Journ. v, p. 28 (1829).—*Chiton strigatus* SOWB., Charlesworth's Mag. of Nat. Hist. 1840, p. 289; Conch. Illustr., f. 63.—*Chitonellus strigatus* REEVE, Conch. Syst. ii, t. 135, f. 6.—*Phakellopleura* (*Acanthochites*) *strigata* SHUTTLW., Bern. Mittheil. 1853, p. 80.—*Chitonellus lævis* REEVE, Conch. Icon. f. 1. Not of Lamarck.—*Choneplax serpens* CPR. *MS., olim.*—*Choneplax strigatus* CPR. *MS.*

The name *latus* is not preoccupied in the *Cryptoplacidæ* and being the earliest published it must be accepted. The valves of this species are greatly eroded in all the specimens I have seen.

C. HASTATUS Sowerby. Pl. 8, figs. 16–22.

Shell small, granulated; valves reclining, acute, *the first five very narrow, the latter three wider;* the last having a pointed terminal apex; margin thick, rude, having minute red tufts at the valves.

Length 9, breadth 3 mill. (*Sowb.*)

Habitat unknown.

Chiton hastatus SOWB., Charlesworth's Mag. of Nat. Hist. 1840, p. 290, Suppl. pl. 16, f. 4; Conch. Illustr. f. 127.—REEVE, Conch. Icon., f. 166.—*Choneplax hastatus* CPR., *MS.*

This may prove to be the young of *C. latus*, the pointed shape of the valves being due to their non-eroded condition; but the slits seem to be more strongly developed. Figs. 16, 17, 18, 19 are from Sowerby's illustrations; figs. 22 are from sketches made by Carpenter from the type.

Carpenter writes of the type specimen: I cannot see the very long hairs figured by Sowerby, but here and there are a few very fine dark hairs, looking like pores, and occasionally but not always sutural; round the margin there are a great many extremely minute, rather distinct hairs. Jugular areas long and narrow, in some valves sculptured and colored like the rest, only finer and with long lyrulæ; in others they are worn and dark colored; in two last valves dark bordered with white, with fine granules over it. Central and side areas not divided, having about 10–12 rows of granules branching out. Inside: anterior valve having 4 slight slits at the end of very long teeth; central valves with one little slit, near the sculptured part; posterior valve with one very decided slit on each side.

APPENDIX I.

The following pages contain the descriptions of certain species omitted in the body of this monograph, and additional descriptive and bibliographic matter relating to other forms.

Family *LEPIDOPLEURIDÆ* (Vol. XIV, p. 1.)

Genus LEPIDOPLEURUS Risso.

L. ALGESIRENSIS Capellini. Pl. 14, figs. 20, 21.

Shell oval, not carinated; whitish-tawny; end valves and lateral areas ornamented with concentric folds; central areas smooth to the naked eye, but longitudinally striated when viewed under a lens. Girdle with moderate scales.

Length 16, breadth 10 mill. (*Capellini.*)

Algesiras, Andalusia (Tarnier); *Coast of Provence* (Martin); *Marseilles* (Marion); *Civitavecchia* (Donati); *Sicily* (Calcara, Aradas, Monterosato); *Palermo* (Monterosato).

Chiton algesirensis CAPELLINI, Journ. de Conch., June, 1859, p. 327, t. 12, f. 3, *a'''*, *b'''*, *c'''*.—CARUS, Prodromus Faunæ Mediterraneæ, ii, p. 180.—*Leptochiton granoliratus* CPR., *MS.*

There can be no doubt of the identity of Capellini's species with the *L. granoliratus* of Carpenter, described from Mogador, which I have described and figured (vol. xiv, p. 14), from examples collected by McAndrew.

Family *ISCHNOCHITONIDÆ* (Vol. XIV, p. 253.)

Genus TRACHYDERMON, Carpenter.

Trachydermon Cpr., PILS., Manual XIV, p. 67.

Craspedochiton SARS, type *C. marginatus* Penn.=*cinereus* L.

Boreochiton SARS, part (*C. ruber* and *marmoreus*).

Lophyrus Sars, (*C. albus* L. and *exaratus* Sars).—THIELE, Das Gebiss ii, p. 379. (L. albus L).

Adriella THIELE, Das Gebiss der Schnecken, ii, p. 391, 1893. Type *A. variegata*, Phil.

Icoplax THIELE, *l. c.*, p. 392. Type *I. punicea* Couth.

Shell oval, carinated. Valves delicate, the lateral areas indistinct; surface minutely granulated, the granulation rather even and

generally in quincuncial pattern. Insertion plates short and sharp, having slits. Eaves solid or slightly porous. Girdle densely clothed with very minute rounded or elongate papillæ. Type *T. flectens* Cpr.

This group was formerly considered a subgenus of *Ischnochiton* by me; but a critical review of the species, with the use of power adequate to thoroughly reveal the structure of the girdle, causes me to reinstate it as a genus. It differs from *Ischnochiton*,—even the smallest species and specimens—in the nature of the girdle covering; and the same is true of its relations with *Chætopleura*, *Callochiton* and *Tonicia*. The first of these three is also distinguished by its peculiar sculpture; the second by its continuous sutural laminæ. *Tonicia* is the genus most allied to *Trachydermon*; and it was no doubt derived from *Trachydermon* at no remote time.

The types selected by previous authors for this group are in no case tenable. Carpenter's original list of Trachydermons comprised *reteporosus, interstinctus, trifidus, dentiens, gothicus, hartwegii, nuttallii* and *flectens*. Of these the first three are Ischnochitons; *hartwegii* and *nuttallii* belong to *Cyanoplax*; leaving only *dentiens, gothicus* and *flectens* available for the choice of a type. The last has been selected.

Within *Trachydermon* three sections may be distinguished, but their differential characters are of little value.

I. *Trachydermon s. str.* (type *flectens* Cpr). Valves thin; gills extending forward $\frac{2}{3}$ to $\frac{3}{4}$ the length of the foot.

II. *Boreochiton* Sars (type *ruber* L.). Valves variegated; gills median. Species, *T. ruber*, *T. punicea*, *T. steinenii*.

III. *Cyanoplax* Pils. (type *hartwegii* Cpr.). Valves solid, thick; eaves wide, pitted; gills as long as the foot. Species, *T. hartwegii*, *T. bipunctata*.

Besides these, a subgenus (*Spongioradsia*) has been created for two divergent forms.

The genus is one of great antiquity, being the least differentiated of the *Ischnochitonidæ*. The girdle is unspecialized, being clothed with minute bodies which cannot be called either scales or spines, for they are of an intermediate character. See pl. 15, figs. 26 (dentiens); 25 (ruber); and 37 (flectens).

Thiele has proposed the "genus" *Adriella* for one of the typical forms, founding it on a very slight difference in dentition, the value

of which he is himself undecided on. Another "genus," *Icoplax*, he proposes for the Cape Horn species *punicea;* this group also has slight peculiarities of dentition, and if such minute subdivision is desirable, it might be retained as a section.

T. ALBUS Linné. (Vol. XIV, p. 70).

Var. *infuscatus* Schneider.

Sculpture, girdle and radula as in the type, but color yellow-brown or brown-black.

West coast of Prince Charles' Promontory; Spitzbergen, Quaenangenfjord, Norway.

See SCHNEIDER, Tromsö Museums Aarshefter, vol. 4, 1881, p. 57, and KRAUSE Zool. Jahrb., 1892, p. 348.

T. FLECTENS Cpr. Pl. 15, figs. 34, 35, 36, 37.

For original description see Vol. XIV, p. 75.

Shell small, ovate-oblong, moderately elevated. *Roseate or deep blood red*, more or less *maculated with blue, especially along the sutural margin;* the blue sometimes predominating on some valves.

Median valves squared and slightly beaked; *minutely granulated all over, more closely on the lateral areas, which are otherwise scarcely defined* (fig. 36). Mucro somewhat anterior, rather projecting (fig. 34).

Interior of a beautiful deep rose color. Anterior valve having 8, median valves 1–1, posterior valve 7 slits. Eaves narrow, short and solid. Sinus slightly laminate.

Girdle rather densely covered with minute, elongated but scarcely imbricating scales (fig. 37), and fringed with hyaline spinelets. Gills extending forward two-thirds or three-fourths the length of the foot.

Length 12, breadth 7 mill.; divergence 110°

Puget Sound (Cpr.); *off Victoria, British Columbia* (Newcombe, 1892); *S. Pedro* (Cooper).

This is a beautiful little species, the examples before me from Victoria, B. C., being especially remarkable for their deep colors. The sculpture and the spotting of the sutural margins reminds one of *T. dentiens*, which is evidently its nearest of kin.

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T. GOTHICUS Cpr. Pl. 15, figs. 28, 29.

The original description will be found on p. 74, vol. xiv.

The type of this little shell was collected at Catalina Island by Dr. Cooper. It is an exceptionally elevated species, the dorsal ridge being acute, and the angle of divergence about 80°. The type (Mus. Smiths. Inst. 16271) having been glued to a glass tablet formerly, is not in very good condition, but Carpenter's excellent description and the figures here given (representing the half of a median valve and a profile of the tail valve), will readily identify it.

T. RUBER L. Pl. 15, fig. 25 (girdle-scales, x 125).

T. DENTIENS Gld. Pl. 15, fig. 26 (girdle-scales, x 250.)

Subgenus SPONGIORADSIA Pilsbry, 1894 (n. s.-g.)

Trachyradsia CPR. in part, exclusive of its type *Ch. fulgetrum.*

Valves smoothish, having two or several side slits, and extremely spongy eaves and sinus, the latter squared. Girdle sparsely beset with minute elongated scales. Type *Tr. aleutica.*

It is somewhat doubtful whether this group should rank under *Callochiton* or *Trachydermon;* but as the girdle, sinus and gills more resemble the latter, I have placed it here. The spongy eaves and radsioid valves resemble *Trachyradsia* (plus Stereochiton), but the sinus in that group, as in typical *Callochiton,* is bridged by a lamina extending across from one sutural lamina to the other.

But two species are known to belong here: *aleutica* Dall and *multidentata* Cpr.

T. ALEUTICA Dall. Pl. 15, figs. 30, 31, 32, 33.

The original description is given on p. 84, vol. xiv.

This is a small, dull purplish-red species, much elevated but rounded at the ridge, valves broadly v-shaped, the anterior border of each being concave, the lateral areas a trifle raised but indistinct, whole surface obsoletely punctulated by the comparatively large megalæsthetes, and showing some lines of growth.

The most prominent characters are presented by the interior of the valves, which are flesh-colored, rather thick, and have the posterior border of the tegmentum broadly reflexed. The wide eaves are coarsely and densely spongy, the teeth being reduced to very slight prominences or wholly obsolete on some valves; but the number of punctate slit-rays shows that the side-slits if developed would

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be several in number. The sinus is very wide and very spongy (fig. 33); the sutural laminæ are high and narrow.

The girdle is somewhat sparsely clothed with blunt white processes, between spines and scales in form, and some of them show under the lens an excessively fine longitudinal striation (fig. 30.)

Gills extending forward two-thirds the length of the foot.

The length is about 6 mill.; divergence 90°–100°.

Aleutian Is.

Views of outside and interior of a median valve, and interior of the head valve are here given. The pores of the eaves and sinus are obviously more than sufficient to afford egress to the minute trunks innervating the megalæsthetes and micræsthetes; and they probably serve in large part for the attachment of the valves to the girdle, being occupied by connective tissue. This accessory means of attachment is perhaps the cause of the great degeneration of the insertion-plates, which are deprived of their main function.

Trachyradsia multidentata Cpr., from the Bonin Is., is evidently closely allied, but it is described as having more strongly developed teeth.

Genus TONICELLA Carpenter.

Vide vol. xiv, p. 40.

Toniciella THIELE, Das Gebiss der Schnecken ii, p. 389.

Key to species of Tonicella.

a. Shell small, less than 10 mill. long; central areas red, lateral areas white, *saccharina.*

aa. Shell larger, much variegated.

b. Speckled and maculated with red; minutely granulated; dorsal angle 90°–100°, *marmorea,* vol. xiv, p. 41.

bb. Having oblique reddish lines; dorsal angle 110°–130.°

c. Very minutely granulated; angle 120°–130°, *submarmorea,* vol. xiv, p. 42.

cc. Not granulated; angle 110°–125°, *lineata,* vol. xiv, p. 42.

T. SACCHARINA Dall. Pl. 15, figs. 22, 23, 24.

See vol. xiv, p. 44.

Figures are here given of a curled specimen, kindly supplied by Dr. W. H. Dall. The girdle is blackish and smooth outside, having a fringe of delicate spicules at the edge, which is curled up in the spec-

imen illustrated. The median valves have an obtuse, projecting beak, the back margin being concave on each side of it, and they are narrowly rounded at the sides, broadly concave in the middle in front (fig. 22). The granulation is hardly visible; the lateral areas are white, central areas red. The dorsal angle is blunt; divergence about 110°. The *T. sitchensis* Midd., which has not been identified since Middendorff's time, should be compared with this species.

Genus CALLOCHITON Gray.

See vol. xiv, p. 48. Add to synonymy of the genus: *Clathropleura* TIBERI (part), Bull. Soc. Mal. Ital. iii, p. 136, 1877. First species *C. lævis.*

C. LÆVIS Montagu. Vol. xiv, p. 49.

As an additional synonym, is probably to be ranked *Chiton euplœæ* O. G. Costa, Cat. Syst. e Rag. Test. due Sicil., p. i, iv, t. 1, f. 4, 1829.

C. CROCINUS Reeve. Vol. xiv, pl. 10, fig. 7.

Shell ovate; terminal valves and lateral areas of the rest concentrically sculptured with waved wrinkles, the surface being most minutely punctured; central areas undulately decussated with minute ridges. Saffron yellow, stained in the middle with light purple. Ligament horny, tessellated. A species most peculiar in color, and not less in sculpture; the surface of the central areas having the appearance of coarse cloth or canvas. (*Rve.*)

Habitat——? (Rve.); (*New Zealand* (Greenwood, *et al.*)

C. crocinus Rv., Conch. Icon., t. 22, f. 146, 1847.—*Lepidopleurus empleurus* HUTT., Tr. N. Z. Inst. iv, p. 178; Man. N. Z. Moll. p. 113, 1880, *teste* Hutton in private letter.

This, if really from New Zealand, is probably distinct from *C. platessa* Gld.; but Dr. Carpenter believed them to be identical.

C. SANGUINEUS Deshayes. Pl. 10, fig. 27, 28.

Shell small, regularly ovate, much depressed, equally obtuse at the two ends; blood red all over; end valves semi-lunar; intermediate valves narrow, tripartite, most minutely granulated when viewed under a lens. Marginal girdle narrow, clothed with small scales, regularly articulated with brown spots.

Length 8, breadth 5, height 1 mill. (*Desh.*)

Islands of Reunion and Mauritius.

Chiton sanguineus DESH., Catalogue des Mollusques de l'Ile de Réunion, p. 40, t. 6, f. 4–7.—*Chiton* (*Lepidopleurus*) *sanguineus* MARTENS in Mobius' Reise nach Mauritius, p. 300.—*Callochiton sanguineus* THIELE, Das Gebiss d. Schn. ii, p. 392, t. 32, f. 9 (dentition.)

Figure 27 is much enlarged. Deshayes compares this species to a dried drop of blood.

Subgenus TRACHYRADSIA Cpr., 1878.

Trachyradsia CPR. in Dall, (part) 1878, type *Ch. fulgetrum* Rve. *vide* Manual, xiv, p. 83.—*Stereochiton* CPR. in Dall, 1882, type *Ch. castaneus* Wood; *vide* Manual xiv, p. 52.

Valves almost smooth, but minutely granulated or punctulate having several slits in each side insertion-plate, very spongy eaves, and shallow sinus, across which the sutural laminæ are connected (see vol. xiv, pl. 9, fig. 90). Girdle bearing minute downy scales. Distribution S. Africa and Tasmania.

This group, as here reformed, claims kinship with *Callochiton;* and so close is the alliance that it has been by Carpenter and myself ranked as a subgenus or section under that genus. The North Pacific forms formerly referred here have been given place under the genus *Trachydermon*, in the section *Spongioradsia.*

C. DENTATUS Spengler. (*C. fulgetrum* Reeve. Vol. xiv, p. 83).

The *Chiton planatus* Spengler (Skrivter af Naturhist.-Selsk. iv, p. 91), is probably the same as *C. dentatus* of the same author (*l. c.*, p. 88), and both seem to agree with *C. fulgetrum* Reeve. Both are said by Spengler to be from the Cape of Good Hope. See also Mal. Bl. xvii, p. 113.

C. CASTANEUS Wood. (Vol. xiv, p. 52.)

Spengler's *Chiton bicolor* (*l. c.*, p. 90, p. 6, f. 18) is this species, and the name has priority, but cannot fairly be adopted on account of the previous use of the name *bicolor* by Gmelin, for a smooth species apparently different and distinct.

C. INORNATUS Tenison-Woods. Pl. 13, figs. 63, 64.

"Shell oval, thin, depressed, of a uniform deep brown, very finely dotted all over with minute depressions like the top of a thimble; valves of a uniform width, keeled, slightly beaked; lateral areas very little elevated, with obsolete radiate striations; central areas finely

marked with concentric striæ; terminal valves not large, obscurely ribbed with broad rounded ribs; margin membranaceous, covered with scattered short silvery hairs.

"The distinction of this species is its very uniform ornamentation. In most of the Chitons there is some marked difference between the lateral and central areas of the valves, but here all seems uniform in the color as well as in the ornament. The lateral areas have concentric lines like those of growth. The minute dots with which the surface is pitted is a feature which this species shares with many others in Australia, but the marks are finer and more shallow than usual. The species is very rare." (*Tenison-Woods.*)

Length 40, breadth 25, alt. 5 mill.

Northern Tasmania.

Chiton inornatus T.-W., Trans. and Proc. of the Roy. Soc. of Victoria, xvii, p. 82, pl., figs. 8, 9 (May 10, 1881).—*Callochiton* (*Stereochiton*) *lobatus* CPR.

The representation of the sutural laminæ upon the *posterior*, instead of the *anterior* border of the single valve illustrated in Mr. Tenison-Wood's drawing, is of course on error; but it is difficult to to see how such a mistake could occur.

I believe that this species is the same as *Callochiton* (*Stereochiton*) *lobatus* Cpr. (Manual xiv, p. 53); and it is upon this ground that I place the form in this genus and section. Tenison-Woods' description and figure give no clue to its generic position. *C. lobatus* Cpr. becomes a synonym.

CHITON FESTIVUS Blainville. Shell quite elongated, carinated; valves narrow, angular like a roof, very finely granulated throughout; lateral areas little indicated; anterior plates of insertion (suture laminæ) narrow, the end plate quadridentate. Color varied with brown, red and flesh color outside; white with a dash of rose within. (*Blainv.* Dict. Sc. Nat. xxxvi, p. 541.)

Seas of Australia.

This is a *Callochiton* of the Section *Trachyradsia*, and may be either *C. fulgetrum*, Rv., *C. castaneus* Wood or *inornatus* T.-Woods; The coloration described resembles the first of these. The locality assigned is not to be trusted.

Genus CHÆTOPLEURA Shuttleworth.

Vide vol. xiv, p. 27. Add to synonyms: *Rhyssoplax* THIELE, Das Gebiss der Schnecken, ii, p. 368, 1893.—(*R. janeirensis* Gray

and *segmentata* Rve.).—*Helioradsia* THIELE, *t. c.*, p. 385 (*H. gemma* Carp.).

The valves are solid, porcellanous within, having rather long sharp teeth and squared sinus. *Externally they are sculptured with longitudinal beaded riblets on the central areas*, and pustules or pustulose ribs on the lateral areas. Mucro in front of the middle. Girdle having corneous hairs, sometimes rising from a dense mass of chaffy scales.

Chætopleura is closely allied to *Pallochiton* in sculpture and valve structure generally, but *Pallochiton* has the mucro far to the rear. Thiele has subdivided the genus, but his divisions are based upon trivial features of the radula, which characterize single species or groups of species of less systematic rank than the assemblages called "sections" in the present work.

The species, although few in number, are found in most warm and temperate seas.

C. HENNAHI *var.* JASPIDEA Gould. Pl. 10, figs. 29, 30.

Shell broad-ovate, thin and light, somewhat strongly carinated; under a magnifier it is found to be everywhere punctured in quincunx. It is generally dark liver-red clouded with longitudinal pencillings of more or less deep rose red colors; central areas closely and minutely marked with granulated, longitudinal lines; lateral areas small, distinguished by their greater smoothness, and having four or five rather imperfect granular lines upon them; terminal valves with radiating lines of distant granules, the posterior one excavated and with a transverse ridge, and strongly marked with the lines of growth. Margin coriaceous, covered with short hoary down. (*Gld.*)

Callao.

Chiton jaspideus GOULD, Proc. Bost. Soc. Nat. Hist. ii, p. 143, July, 1846; Expedition Shells, and Otia Conch. p. 4; U. S. Expl. Exped., p. 325, atlas f. 414, 414*a*.—*Chætopleura jaspidea* THIELE, Das Gebiss d. Schn. ii, p. 380, t. 31, f. 12 (dentition.)

This is probably a mere form or variety of *C. hennahi*, distinguished by the greater prominence of the pustules upon the lateral areas.

C. ASPERRIMA (Couthouy) Gld. Pl. 14, figs. 1, 2.

Shell elongated-oval, narrowed anteriorly, moderately convex, subcarinate, brownish-olive along the back, with a lilac bloom at the

margin; posterior valves semi-lunar; lateral areas large, extending quite to the anterior edge of the valves, ornamented with irregularly scattered, cylindrical eminences, which are easily detached, leaving a scar; the central areas have thick-set, longitudinal ranges of similar eminences. Margin coriaceous, covered with short and scattered setæ. (*Gld.*)

Length one inch; breadth two-fifths of an inch.

Ilha do Pai, at the entrance of Rio Janeiro Harbor (U. S. Expl. Exped.)

Chiton asperrimus Couth. *MS.*, GOULD, U. S. Exploring Exped. Moll., p. 326, f. 418 *a-b*.

This is evidently a *Chætopleura* of the *C. apiculata* group. Gould's figures do not show the girdle satisfactorily. Gould compares the granules to little cylindrical pedestals.

C. TEHUELCHA Orbigny. Vol. xiv, p. 205.

This seems to be a *Chætopleura*, allied to *C. fulva*, rather than a *Tonicia*. I have not seen specimens.

C. FULVA Wood. Vol. xiv, Pl. 44, figs. 62, 63, 64.

Shell oval or oblong, elevated, acutely carinated, solid. Color pale buff suffused with rich orange-red toward the apices of the valves, or dull reddish all over, with white threads on the central areas.

Valves strong, somewhat beaked; central areas sculptured with white longitudinal beaded threads, separated by flat dark spaces; the threads are irregular at the jugum, often divaricating or anastomosing. Lateral areas slightly raised, having several subobsolete radii; end valves obsoletely radiated.

Interior white, having faint brown streaks diverging from the apices. Sutural plates rounded; sinus angular, not toothed. Anterior valve having 9–11, central 1, posterior 9–11 slits; teeth conspicuously, coarsely, pectinated outside, crenulated at their tips, and rather obtuse. Eaves short, solid, narrowly grooved along the teeth.

Girdle leathery, light brown, bearing small, scattered and whitish hairs. Length 33, breadth 19 mill.

Portugal.

Chiton fulvus WOOD, General Conchology, p. 7, t. 1, f. 2.—SOWERBY, Conch. Illustr., f. 53, 83.—REEVE, Conch. Icon., f. 39.—*Chætopleura fulva* ROCHEBRUNE, Miss. Sci. Cap Horn, p. 137.—THIELE, Das Gebiss d. Schn. ii, p. 381, t. 31, f. 16 (dentition).—

Tonicia fulva GRAY, P. Z. S. 1847, p. 67, and of CPR., *MS.*—*Ch. fulvus "var.? (velatus),"* SOWB., Conch. Illustr. no. 69, f. 53 (no desc.).

Doubtful synonyms: *Chiton angulatus* SPENGLER, Skiivter af Naturhist. Selsk. iv, p. 71.—*Chiton ferrugineus* SPENG., *l. c.*, p. 72. *Cf.* Mörch, Mal. Blätter, xvii, p. 111.—*Chiton lusitanicus* TILESIUS, Jahrbuch der Naturgeschichte i, p. 221, t. 6, f. 3, 4, 5, (Leipzig, 1802).—*Chiton candisatus gaditanus* CHEM., Conch. Cab., x, p. 374, t. 173, f. 1691.

Wood has given a perfectly recognizable portrait of this species; and I have therefore hesitated to disturb the current use of his specific name in favor of those proposed by either Spengler or Tilesius, about which there is more or less uncertainty.

This species has hitherto been classed in *Tonicia*, but the total absence of eye-spots, the hairy girdle and the less obtuse teeth show it to belong rather to *Chætopleura*.

Said to have been taken at Cape Horn on ships cable, but this locality requires confirmation.

C. PAPILIO Spengler. Vol. XIV, pl. 44, figs. 57, 58, 59, 60, 61.

Shell oval, rather elongated, elevated, the dorsal ridge obtuse. Of a deep chestnut color.

Valves deeply indented at the sutures; lateral areas moderately raised, and (with the end valves) generally marked with delicate radii; central areas having some delicate longitudinal striæ. Posterior valve with the mucro central and rather elevated.

Interior: posterior valve having 8–10, central valves 1–1, anterior valve 8–10 slits; teeth acute; sinus rather wide, flat, laminate, with a slit at each side. Eaves solid.

Girdle wide, clothed with rather stout and long curling black hairs.

Length 63, breadth 33 mill.; divergence about 105°.

Cape of Good Hope.

Chiton papilio SPENGLER, Skrivter af Naturhistorie-Selskabet, iv, p. 86, t. 6, f. 15.—*Ch. castaneus* QUOY & GAIMARD, Zool. Astrol. p. 387, t. 74, f. 33, 34.—*Ch. watsoni* SOWB., Mag. of Nat. Hist. 1840, p. 288; Conch. Illustr., f. 81, 82, 130.—KRAUSS, Die Südafrik. Moll. p. 41.—REEVE, Conch. Icon. iv, t. 6, f. 32*a*, *b*.—*Chætopleura watsoni* THIELE, Das Gebiss d. Schn. ii, p. 380, t. 31, f. 15 (dentition.)

The following names are probably to be considered synonymous, but I have not seen the types, which alone can fix their identity.

Chiton fuscus Gmelin, Syst. Nat. xiii, p. 3204, founded upon *Chiton Linter Indiæ orientalis* Chemnitz, Conchylien Cab. viii, p. 279, pl. 95, f. 799, 800. This name, if it really belongs to the species, will take precedence of *papilio*, being anterior in date. The specimens figured by Chemnitz were from the cabinet of the *Gesellschaft naturforschender Freunde zu Berlin.*

Chiton linter REEVE, Conch. Icon. iv, pl. 13, f. 72 (March, 1847), identified by Reeve with *Ch. linter Indiæ orientalis* Chemn., in ignorance of Gmelin's prior binomial for the same Chemnitzian form. Reeve's description is as follows: "Shell oblong, a little attenuated anteriorly, valves swollen in the middle, smooth or very minutely impressly striated throughout; yellowish-brown, painted along the middle of each valve with a remarkable triangular brown spot, yellowish on each side; ligament horny, transparent, beset with rather distant rough horny grains. Chemnitz, Conch. Cab., vol. viii, p. 279, pl. 95, f. 799. Hab. East Indies. This is another interesting species of Chiton which I have the pleasure of restoring from the obscurity in which it has remained since the publication of the 'Conchylien Cabinet,' in 1785."

Reeve's figure is copied on pl. 49, fig. 35 of vol. xiv. It is probably a worn specimen of *papilio.*

C. PUSTULATUS Krauss. Pl. 10, figs. 23, 24, 25, 26.

Shell oblong-ovate, convex, beautifully painted with spots of white, yellow, rufous and brown, banded in the middle with white.

Anterior valve, posterior area of the posterior valve, and lateral areas of the intermediate valves very delicately punctulate and *sparsely sculptured with elevated, cylindrical pustules. Central areas longitudinally subgranose and cancellated.*

The insertion-plate of the anterior valve is weakly striated, projects widely beyond the eaves, and has 9 slits. Middle valves with 1 slit, posterior insertion-plate much shorter, having 8 slits.

Girdle reddish-yellow, sparsely clothed with long brownish hairs.

Length 13, breadth 8 mill.

Natal, on the shore (Wahlberg.)

Chiton pustulatus KRAUSS, Die Südafrik. Moll., p. 42, t. 3, f. 7.

I have not seen this pretty *Chætopleura*, the description of which is translated from Krauss' excellent book.

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C. ASPERIOR Carpenter. Pl. 15, figs. 38, 39, 40, 41.

Shell small, acutely keeled, the side-slopes straight. Buff-white, marked with purple-black at each side of the dorsal ridge, and at the outer extremity of each valve. Girdle tessellated light and dark.

The median valves are squared, minutely beaked; lateral areas slightly raised, and sculptured with about *three radial rows of sparsely placed pustules,* subject to considerable irregularity. *Central areas having 7–9 longitudinal series of beads on each side, those near the middle converging and smaller.* Anterior valve having 18 radial rows of white pustules standing on slight, dark, narrow riblets. Posterior valve having the mucro slightly in front of the middle, posterior slope concave, with sparsely scattered pustules.

Interior white, slightly stained under the beaks. Anterior valve having 8, median 1–1, posterior valve 9 slits; teeth long and sharp; eaves short and solid. Sinus narrow, supplied with a narrow concave-edged lamina, notched at each side.

Girdle densely clothed with minute chaffy scales, with occasional long corneous hairs (fig. 38).

Length 11 mill.; divergence 130°.

Off East Asia.

"*? Trachydermon*" *asperior* CPR. MS.; *vide* Pilsbry, Manual xiv, p. 77.

The type of this species is a single specimen (Smiths. Inst. Mus. 24121) in excellent preservation. Valves i, vii, and viii are detached, the latter two being illustrated on my plate. It is somewhat surprising that Carpenter called this a *Trachydermon,* for it is an unequivocal *Chætopleura* in girdle, eaves, sculpture and indeed the whole aspect. It belongs to the group of *Ch. gemmea.*

Genus ISCHNOCHITON Gray (Vol. XIV, p. 53).

Ischnochiton GRAY and authors, type *longicymba.*

Radsiella THIELE, Das Gebiss der Schnecken ii, p. 368, for *punctulatissimus* Sowb., *concinnus* Sowb., *capensis* Gray, *caliginosus* Rv., *tessellatus* Q. & G., *rugulatus* Sowb. Not *Radsiella* Pilsbry, Man. Conch. xiv, p. 54, 139 (July 25, 1892).

Stereoplax THIELE, *t. c.,* p. 383, for "*multicosiata*" C. B. Ad.

Rhodoplax THIELE, *t. c.,* p. 384, for *squamulosa* C. B. Ad. and *erythronotus* C. B. Ad.

Lophyriscus THIELE, *t. c.*, p. 377, for *textilis* and *oniscus*.

Beanella THIELE (not Dall!) *t. c.*, p. 388 for *rissoi* Payr. and *cajetana* Poli!

Dr. Thiele has added a considerable number of synonyms to this genus. His group *Radsiella* consists of small subtypical *Ischnochitons* and one true *Chiton* (capensis). His *Stereoplax* is founded upon the type of the Ischnoid section *Ischnoplax* Cpr. (see Vol. XIV, p. 64, 65); and he has placed the same species under another name in his "*Stenoplax*." He fails completely to understand the true characters of *Stenoplax* Cpr., including Lepidozonas only under that name. *Rhodoplax* contains two small species of *Ischnochiton*. *Beanella* is an odd compound of *Ischnochiton* and the type of *Lepidopleurus*. The true *Beanella* belongs to *Nuttallina*, q. v.

I. PURPURASCENS C. B. Ad. (Vol. XIV, p. 58.)

Has been collected at *Bermuda* by Goode, I am informed by Dr. W. H. Dall.

I. RADIANS Cpr. Pl. 16, figs. 48, 49.

Shell oval, rather depressed, carinated, the side-slopes straight. Surface lusterless. *Color olive-purplish, radially streaked with whitish dashes or flames*, having some purple patches, and *on the diagonal line a few snow white spots*; ridge of valves purple or white.

Median valves smooth to the naked eye, the *lateral areas indistinct, not raised*, having a few subobsolete radial riblets. *Entire surface of all valves evenly, densely and most minutely granulated.* End valves having narrow, low, indistinct, numerous radial riblets hardly visible except toward the periphery. Mucro in front of the middle, moderately prominent; the posterior valve being shaped as in *I. retiporosus*.

Interior dark blue. Anterior valve having 10, central valves 1–1, posterior valve 10 slits. Sinus squared, the sutural-plates not continued across it.

Girdle speckled, densely covered with shining, rather weakly striated convex scales measuring about $\frac{1}{8}$ or $\frac{1}{7}$ of a mill. in width.

Gill row as long as the foot.

Length about 12, breadth 7 mill.; divergence 120°.

Monterey, Cal.; San Pedro (Cooper.)

The original description will be found on p. 121 of vol. xiv. Carpenter's type was from Monterey, and was a larger specimen than that here figured and described, which is Mus. Smiths. Inst., 19470.

The prominent specific characters are the coloration, which is much like typical *Mopalia lignosa* Gld., and the apparently smooth surface, seen under a lens to be very densely, evenly granulated throughout, and having fine, low, subobsolete riblets on the lateral areas and end valves. These riblets are hardly visible unless viewed under a cross light with a good lens

I. SCABRICOSTATUS Cpr. Pl. 16, figs. 55, 56.

Shell oval-oblong, rather elevated, the dorsal ridge strongly carinated; side-slopes slightly convex. *Orange colored,* with a few darker spots along the riblets of the lateral areas and the posterior margin of each valve.

Median valves slightly and obtusely beaked (when not eroded), having slightly raised *lateral areas, which are weakly, almost obsoletely tricostate,* and bear a few inconspicuous low nodules, more numerous on the posterior riblet; the entire lateral areas being covered with a granulation similar to that of the central areas. *Central areas closely and minutely scaly-granulose in the middle, ribbed at the sides,* the granulation extending over the riblets, crenulating them and causing the interstices to appear pitted.

Anterior valve granulated, and having many (about 24) delicate riblets, which are obsoletely pustulose. Posterior valve smaller than the anterior, having the mucro slightly in front of the middle, sculptured like the head-valve, but with less distinct radii.

Interior flesh colored. Anterior valve with 10, median valves 1–1 slits. Sinus wide, squared.

Girdle orange colored, densely covered with very minute, unusually *wide and short, striated scales, each measuring about one-ninth of a mill. in width.*

Length about 7½, breadth about 4½ mill.; divergence 95°.

Catalina Island, California.

Carpenter's description, given on p. 121 of vol. xiv, is misleading in the account of the sculpture. It has no " rows of prominent granules." The entire surface is shagreened, the second valve (drawn in figure 56) has several short radiating riblets in the front of the dorsal tract; the other valves have longitudinal riblets developed on the pleura only. The scale-like granulation of this species is coarse, when we consider the size of the shell, but the girdle scales are unusually small, very short and broad.

But one specimen is known to have been found, this being no. 16268 of the Smiths. Inst. Coll.

I. RETEPOROSUS Cpr. Pl. 16, figs. 47, 50, 51, 52, 53.

The original description will be found on p. 75 of vol. xiv.

The shell is rather elevated, distinctly carinated, the side-slopes nearly straight. The color is either (1) *dull buffish gray-white* touched with reddish orange at each beak, or (2) a very pretty shade of *reddish-purple, uniform or with a white dorsal stripe* and some faint light spots; in either case the girdle is of the same color as the valves, with or without black scales scattered over it. *The valves are partially covered by a black deposit* in all of the individuals seen.

The slight beaks of the median valves do not modify the slightly concave contour of the posterior border. The lateral areas are not raised; *sculpture consisting of a variable number* (generally 4–7) *of rather acute radiating riblets* (spreading somewhat like those of a *Pinna*) *bearing sparsely scattered, minute pustules which are often lacking* on some or all valves; the intervals between riblets finely granulated. *Central areas sculptured with a very beautiful and clearly-cut pattern of squarish pits or cells formed by the crossing of fine forward-converging riblets by others curving in a radial direction* (fig. 47). Anterior valve having many narrow radial riblets, like those of the lateral areas, some of them generally with minute pustules. Posterior valve (figs. 51, 52) having the mucro in front of the middle.

Interior bluish-white or pink. Anterior valve having 11, median valves 1–1, posterior valve 11 slits. *Sutural laminæ low* and rounded, *continuing in a narrow lamina across the shallow, wide, gently rounded sinus.*

Girdle covered with solid rather flattened scales measuring about one-sixth of a mill. in breadth, and coarsely, deeply striated (fig. 50).

Length 15, breadth 8 mill.; divergence 95–100°.

San Pedro, California (Cooper); *Victoria B. C.*, 15 fms. (C. F. Newcombe.)

The type (Mus. Smiths. Inst., 14917) is a light colored specimen, touched with orange at the beaks, as first described above. Others before me from Victoria B. C. have the same coloration, but most of those I have seen from Victoria are purple. The small acute pustules of the lateral areas are very variable, often entirely wanting. The delicate riblets of the lateral areas are generally more numerous than shown in fig. 47, which is drawn from Carpenter's type; they have a strong tendency to split.

Var. PUNCTATUS Whiteaves.

Sculpture as in reteporosus, but the riblets of end valves and lateral areas are more delicate, subobsolete; and the network of the central areas is shallower. Color pale cream, nearly white, with a spot of orange-brown on the ridge of valves ii to viii, and a few irregular spots of reddish on the white girdle.

Length about 8 mill.; divergence 100° (specimen somewhat curled).

Discovery Passage, at Duncan Bay, Vancouver Island, 10–20 fms. (Dawson).

Leptochiton punctatus WHITEAVES, Trans. Roy. Soc. Canada, iv, Sect. iv, p, 125, figs. 1886.

This very pretty form may for the present be retained distinct as a color-variety, but intermediate specimens must be expected. The occasional, rather spaced growth lines are more marked than in the typical *reteporosus.* I am indebted to J. F. Whiteaves F. G. S. for an opportunity of examining the type specimen (at present unique), which is the property of the Canada Geological Survey.

I. SERRATUS Cpr. Pl. 16, figs. 42, 43, 44, 45, 46.

The original description is given on p. 122, vol. XIV.

The shell is moderately elevated, bluntly angled along the ridge, side-slopes nearly straight. *Color light buff,* with small olive spots sparsely scattered along the dorsal ridge and the posterior margins of each valve, and having some irregular orange maculæ on the pleura of some valves.

The intermediate valves are *very minutely and densely granulated throughout*; lateral areas raised, composed of 2–3 (on one side of valve ii, 5) wide rounded ribs; *the hind border of each valve very unevenly toothed* (fig. 43). *Central areas having about* 12 *longitudinal low riblets on each side, crossed by several transverse riblets,* producing a shallow and not very distinct appearance of grating. *The head and tail valves each have about* 20 *low ribs,* like those of the lateral areas. Tail valve with subcentral mucro (figs. 42, 44.)

Girdle faintly tessellated with delicate green and whitish, clothed with solid, somewhat flattened scales, averaging one-sixth of a mill. in width, and when unworn they are *very delicately striated* (fig. 45, x 150 diameters). The individual scales are dull bluish, fading at the edge.

Length 8½, breadth 5½ mill.

Cape St. Lucas.

The type of this species (Mus. Smiths. Inst., 16204) is a pale little Chiton, the color spots being very inconspicuous. The "grating" of the central areas is rather shallow; the pits are mostly squarish. The posterior denticles of the valves are unequal and irregularly spaced. The girdle-scales have a stony appearance, and only reveal the striæ under strong magnification, and some scales do not show it at all.

I. CONCINNUS Sowerby. Pl. 10, figs. 21, 22.

Shell oval, wide, subdepressed, most minutely granulated, subcarinated: valves straight; lateral areas inconspicuous; margin wide, minutely scaly.

Length one-half, breadth three-eighths inch. (*Sowb.*)

A very neat, small, dark colored species; granulated, but so minutely as to appear smooth. It is distinctly keeled, yet depressed. The lateral areas are not very distinctly separated from the central. The margin is broad and scaly; the color dark olive, in some specimens nearly black; inside green. (*Sowb.*)

Chonos (Mus. G. B. Sowerby, Sen.); *Beloncabi* (Dr. R. A. Philippi).

Chiton concinnus SOWB., Charlesworth's Mag. of Nat. Hist. (n. ser.) iv, June, 1840, p. 293; Conch. Illustr., f. 117, 118.—*Radsiella concinna* THIELE, Das Gebiss d. Schn. ii, p. 369, t. 30, f. 19 (dentition).

This form seems to be nearest to *I. punctulatissimus* Sowb. (vol. xiv, p. 115). I have not seen specimens.

I. INCA d'Orbigny. Vol. XIV, Pl. 27, figs. 52, 53, 54.

Shell oblong, whitish, depressed, subcarinated; evenly and very minutely granulated. Length 9 mill. This species is remarkable for its uniform white tint, for its much depressed, subcarinated form, the surface evenly marked with very small points throughout except on the median line, the lateral areas slightly indicated. The margin is very finely scaly. (*Orb.*)

Islay, Peru, in deep water.

Chiton inca ORB., Voy. dans l'Amér. Mérid., p. 486, t. 65, f. 20–24.

Probably belongs to the group of *Isch. punctulatissimus.* The gills are represented as ambient.

I. BERGOTI Velain. Vol. XIV, Pl. 27, fig. 51.

Shell elongated, quite narrow, oval, convex and subangulated on the median line, perceptibly narrower in front; color a rather deep brown-grayish.

Intermediate valves unequal, rather wide, ornamented with transverse lines impressed in the thickness of the shell, subimbricating, very strong in front and on the lateral portions, where they generally number 3 or 4. The upper portions are smooth or marked with irregular punctations only. End valves semilunar, having impressed striæ like the others, but more numerous, stronger and concentric; anterior valve much narrower and more angular than the posterior; intermediate valves unequal, with the lateral areas narrow, not distinctly indicated; dorsal [central] areas wide, finely punctate. Border of the mantle yellowish, but little developed, without scales or spines, marked by fine granulations only. (*Velain.*)

Length 15, breadth 7, alt. 4½ mill.

Island of St. Paul, on rocks in the littoral zone, rare. (French Transit of Venus Expedition to St. Paul and Amsterdam, 1874).

Chiton bergoti VELAIN, Comptes Rendus de l'Acad. des Sci., vol. 83, p. 285, July 24, 1876 (name only); Arch. Zool. Expér. et Gén. vi, p. 123, t. 4, f. 21, 22. 1877.

The prominent features of this species seem to be the several concentric grooves along the anterior and lateral borders of each of the valves, the surface elsewhere punctate. It is probably an *Ischnochiton*, although Velain says that the girdle is not scaly but papillose, which suggests *Trachydermon*. It was collected only within the Crater. The surface is generally corroded, and covered with calcareous incrustations and Serpulæ.

I. CONSTANTI Velain. Vol. XIV, Pl. 27, fig. 49.

Shell oblong, quite thin, uncolored or yellowish-white, equally obtuse at the two ends. Terminal valves unequal, semilunar, the anterior more acute at the summit than the posterior; both ornamented with concentric striæ, as in the preceding species (*bergoti*). Intermediate valves narrow and equal; lateral areas elongated, moderately developed but little prominent or distinct. External surface little convex, with a median angle more or less pronounced; apparently smooth, but with a strong lens seen to be ornamented with fine granules in very regular series. Border of the mantle narrow, whitish or gray, and distinctly scaly.

Length 8–9, breadth 4–5, alt. 2½ mill. (*Velain*).

Islands of St. Paul and Amsterdam (French Transit of Venus Exped., 1874).

Chiton constanti VELAIN, *l. c.*, p. 124, t. 4, f. 21, 22.

This species is abundant throughout the littoral zone of both islands, especially within the crater of St. Paul, where it covers some rocks.

I. CESSACI Rochebrune. Pl. 10, figs. 13, 14, 15, 16, 17.

Shell ovate-oblong, subcarinated, painted with various colors. Anterior valve and posterior area of the posterior valve lightly concentrically lineated, the lines most minute; intermediate valves having the central areas striatulate, striæ interrupted; lateral areas very delicately undulated. Marginal ligament narrow, scaly.

Length 18, breadth 8 mill. (*Rochebr.*)

Strait of Santiago, Cape Verde Archipelago, (Cessac and Bouvier.)

Lepidopleurus cessaci ROCHEBR., Bull. Soc. Philom. 1881, p. 118; Nouv. Arch. du Mus. (2) iv, p. 241, t. 17, f. 11, *a-e.*—*Leptochiton cessaci* ROCHEBR., Journ. de Conch. 1881, p. 43.

This species is evidently allied to *I. rissoi* Payr.

In the great number of specimens from Cape Verde and the whole west coast of Africa (Bank of Argain, Dakar, Goree, Rufisque and Madeline Is.), twelve color varieties are found, as follows.

1. Greenish yellow with a brown median line, mantle white.
2. Deep yellow orange; mantle light yellow.
3. Dark brown with a white median line; mantle gray.
4. Dark violet; mantle blue.
5. Light violet; marbled with white; mantle rose.
6. Olive; mantle white or black.
7. Uniform gray; mantle blue.
8. Gray-white; mantle orange.
9. Gray marbled with orange; mantle violaceous.
10. Rose; mantle gray.
11. Rose, marbled with green; mantle yellow.
12. Finely marbled with red, blue, yellow on a gray or rose ground.

I. RUGULATUS Sowb. (Vol. XIV, p. 110.)

The name was spelled "*regulatus*" in the text, by typographical error.

I. VIRGATUS Reeve. (Vol. XIV, p. 78.)

This is a smooth-scaled *Ischnochiton*, grouping with *I. smaragdinus* and *I. lentiginosus.*

I. LENTIGINOSUS Sowerby.

See Vol. XIV, p. 135. This species has been rediscovered by Dr. J. C. Cox at Port Hacking, N. S. Wales. It is a smooth form, with convex, polished girdle-scales, and is remarkable for the coloration of *blue spots* on an orange, orange-brown or olivaceous ground. It is apparently distinct from *I. cyaneopunctatus* Kr.

Section HETEROZONA Cpr. (Vol. XIV, p. 65).

H. CARIOSA Cpr. Pl. 14, fig. 8.

A figure is here given of a larger specimen from the collection of the Geological Survey of Canada. It has the girdle scales more unequal than shown in pl. 24, fig. 21, and they are narrower and more elongated. The granulation of the central areas shown in fig. 20 is much too coarse. A considerable number of specimens received from Dr. J. C. Cox, show great variation in the girdle covering, fully covering the differences between figs. 21 and 23 of pl. 24.

Section *Lepidozona* Pilsbry.

Ischnochitons having the girdle-scales strongly convex, smooth or striated; valves with a lamina across the sinus, separated from the sutural laminæ by a notch, and often denticulate; teeth subrugose; mucro low, inconspicuous, nearly flat, subcentral. Sculpture consisting of pustules or graniferous ribs on lateral areas and end valves, and longitudinal riblets on the central areas, the interstices usually latticed.

This section, as here amended, is a very useful one, comprising Ischnochitons of the *mertensii* group on the west coast of America, and the *coreanicus* group on Sino-Japonic shores.

I. CULTRATUS Cpr. Pl. 17, figs. 57, 58, 59.

The original description is given on page 131 of vol. XIV.

The shell is rather elevated and rather sharply carinated, the side-slopes nearly straight. Color whitish or light green, indistinctly mottled and spotted with dark green.

Intermediate valves squared, not in the least beaked. Lateral areas raised, *having four low rounded ribs* separated by rather acute interstices, *each rib bearing widely spaced, elevated pustules of a reddish-brown color*, the posterior border of the valve having *an addi-*

tional series of pustules which dentate the sutures. Central areas having about 16 *acute, narrow, elevated longitudinal ribs,* becoming divergent at the outer angle; those at the dorsal ridge smaller and more crenulated; the deep and wide interstices being finely, irregularly wrinkled across. *Anterior border of tegmentum elegantly scalloped.* Anterior valve having about 13 (or more) low rounded ribs, bearing brown pustules, like the lateral areas; many of the ribs splitting into two or more toward the peripheral margin, the rows of pustules doubling to correspond. *Posterior valve having the mucro flat, and a trifle in front of the middle;* the posterior profile of the valve sloping regularly down from the front margin (fig. 59.)

Interior white, with a *wide dark green ray on each side behind, and a green patch on each side in front of the valve-callus.* Anterior valve having 8, median 1–1, posterior 9 slits; teeth acute, but finely roughened inside and out toward the edge. Sinus straight, not denticulate, having a narrow lamina separated from the sutural-laminæ by a notch on each side (fig. 58.)

Girdle covered with *convex,* weakly striated scales, averaging ·37 mill. in width (fig. 57).

Length about 17, breadth about 12 mill.; divergence 108°.

Hakodadi, Japan.

The specimen figured is one of the original lot, no. 24144 of the Smiths. Inst. Mus. The comparisons given on p. 132, of vol. xiv, readily distinguish this from the allied forms.

The riblets of the second valve diverge at the ridge.

I. BISCULPTUS Cpr. Pl. 17, figs. 60, 61.

The original description is given on p. 119, vol. xiv.

The shell is thin, small, elevated, acutely carinated, the side-slopes nearly straight. Pale green or yellow, maculated with dull green.

Intermediate valves (fig. 61) squared, not beaked. Lateral areas raised, very minutely granulated, *showing a shallow sulcus down the middle, and bearing three* (on valve ii, four) *irregular radial series of sparsely placed pustules;* the posterior ones few, and somewhat dentating the sutures; the median series often reduced to very few pustules. *Central areas having on each side about* 10 *narrow, elevated longitudinal liræ,* their interstices wide and finely, densely, latticed across; *the ridge of each valve free or nearly free of ribs,* minutely granulated. Anterior valve minutely granulated, and

having about 18 radiating, irregular series of pustules. Posterior valve having the mucro subcentral, much depressed.

Interior whitish, but showing through the white layer the tints of the exterior. Anterior valve having 11, median valves 1–1, posterior valve 7 slits; teeth short. *Sinus with a concave, smooth lamina*, separated from the sutural laminæ by a notch at each side (fig. 61.)

Girdle alternately gray-blue and whitish, densely clothed with scales, unequally but generally rather deeply striated, and measuring ·2 to ·25 mill. in width (pl. 17, fig. 60).

Gills slightly over ¾ the length of the foot.

Length 11, breadth 6 mill.; divergence 100° to 110°.

Hong Kong, China.

This types of the species (Mus. Smiths. Inst. 24117) are before me. The shell closely resembles *I. cultratus* in general characters, sharing with that species its general plan of sculpture, depressed mucro, etc. But it differs in the partial or total absence of ribs at the dorsal ridge; in the concave lamina across the sinus; in the fewer pustules, and the smaller girdle-scales; but this last feature may be partly due to the fact that the specimens are much smaller than those of *cultratus*. The sculpture upon the ridge of the second valve is divergent, as in the other species of *Lepidozona*.

I. CRATICULATUS Gould. Pl. 17, figs. 62, 63.

See p. 130, vol. xiv.

Shell elevated and carinated, the side-slopes slightly convex. Color light olive-gray, with rather small dark blue-green spots, mainly visible on the central areas and along the sutural margins.

Median valves squared. Lateral areas a trifle raised, *sculptured with* 8–10 *low radial riblets bearing elevated rounded pustules;* the riblets fewer in young shells; posterior row of pustules dentating the sutures. *Central areas having* 18–22 *narrow longitudinal elevated threads, divergent on the ridge of each valve,* their interstices minutely latticed. *Anterior valve having about* 50 *pustuliferous riblets.* Posterior valve elevated, high at the front margin, the the mucro central and inconspicuous.

Interior bluish or greenish-white, each intermediate valve having a pair *of wide posterior rays of olive-green, and a small patch of the same color at the bases of the sutural laminæ.* Anterior valve having 10, median valves 1–1, posterior valve 11 slits; the teeth unequal, and in the head valve distinctly *notched or nicked at the edges and*

deeply, coarsely grooved outside. Sinus with a somewhat concave lamina, a trifle denticulate in some valves, and nicked at each side.

Girdle gray, covered with convex, striated scales measuring ·33 to ·37 mill. in width (fig. 63).

Length 25 mill.; divergence about 95°.

China Seas or Japan.

The type is a well-grown specimen, evidently adult, and complete except that valve vii has been lost. Valves i, vi and viii are detached, and the last has lost its sculpture posteriorly from an ill-judged cleaning with some sharp instrument. The remaining valves and the girdle are perfect.

This is a well-characterized species, being separated from other allied Lepidozonas by the more numerous radii of lateral areas and end valves. It must, however, be carefully compared with *I. coreanicus* A. & R. (Vol. XIV, p. 129), which is prior in date, and which I suspect may prove the same, although I have not seen an authentic specimen. Reeve's figure of *coreanicus* is said by him to be enlarged, but the actual size is not stated.

I. LUZONICUS Sowerby. Vol. XIV, pl. 38, figs. 31, 32 (enlarged).

Shell oval, angulate, straw-colored with longitudinal streaks of green; lateral areas and end valves radially granulated; central areas acutely longitudinally sulcate; margin nearly smooth.

Length 9, breadth 5 mill. (*Sowb.*)

Luzon, Philippines, on dead shells in 15 fms.

Chiton luzonicus G. B. SOWERBY, JR., P. Z. S. 1841, p. 104.—REEVE, Conch. Icon., t. 25, f. 167.

Carpenter's remarks upon the type specimens are as follows: 6 specimens, Mus. Cuming. In very poor condition; must have lost the girdle scales, and faded in color. Looks extremely close to the young of *coreanicus*, which *I think it is.* The lateral areas have 5 or 6 close granular ribs; central areas having 11 sharp, distinct riblets on each side; the riblets are granulose and are a little decussated between; jugum sharp. Girdle has very few scales to be seen, but these seem to be like *Lepidopleurus*, not very large but roundish. Another specimen has about 17 very close moniliform riblets on the central areas, the side areas raised but ribbed only very indistinctly, with scattered grains on them. The scales of this shell are *very much smaller*, and Ischnoid, striated, flat.

Posterior valve having 14, central 1, anterior 12 slits; typically Ischnoid; teeth sharp, very thin; sinus appears smooth, rather deep.

Length 8½, breadth 4⅔ mill.; divergence 108°.

Carpenter does not state whether the interior described is that of the "*Lepidopleurus*" or the *Ischnochiton* which are included under this species. Probably both are young, and the types evidently require further study. The name *luzonicus* should be restricted to the form with convex, smooth scales, and the systematic position of it is probably in the section *Lepidozona* of *Ischnochiton*.

Section *Ischnoradsia* Shuttlew.

I. TRIFIDUS Cpr. Pl. 17, figs. 64, 65, 66, 67.

See Vol. XIV, p. 141, for the original description.

The shell is elevated and carinated, side-slopes slightly convex. Color reddish-brown, maculated with buff and purple-brown, the dark color generally predominating.

Valves squared, not beaked. Lateral areas slightly elevated, *cut into three low, flat ribs by two radial narrow grooves*, which are generally somewhat pitted. *Central areas having a number of rather strong wrinkles or grooves, in the direction of growth-lines, these grooves being conspicuously pitted or punctured*, and closer toward the anterior margin of each valve. Immediately in front of the diagonal slope, especially toward the beaks, the pitting is finer and closer. Anterior valve having about 18–23 broad, low ribs, separated by linear, punctured interstices. Posterior valve having the mucro central, bent downward, but little projecting.

Interior white, with purplish-red rays posteriorly. Anterior valve having 13, median valves 2–2, posterior valve 13 slits, teeth distinctly roughened, almost pectinated outside. Across the sinus there is a narrow lamina, notched where it joins the sutural-laminæ.

Girdle compactly covered with solid, rather convex scales, which are about ·3 to ·33 of a mill. in width (fig. 66).

Length 27, breadth 17 mill.; divergence 100°–110°.

Sitka to Victoria, British Columbia, 9–18 fms.

This species is more correctly referred to *Ischnoradsia* than to *Radsiella*, the scales being smooth and rather convex. It has no near allies, the pattern of sculpture being extremely peculiar and distinct from all other chitons which I have seen. The closeness of

the pits varies much. At the sides of the pleura there are generally visible slight forward-converging riblets, pitted where they cross the transverse grooves; and these give a key to the origin of this curious pattern of sculpture. Some black scales are scattered among the reddish ones, on the girdle, and it is besides slightly tessellated with lighter.

Fig. 64, 65, is drawn from the type specimen (Mus. Smiths. Inst. 30946); fig. 67 is from a specimen taken at Victoria, B. C., in 15 fms., by Mr. C. F. Newcombe.

I. AUSTRALIS Sowerby. (Vol. XIV, p. 144). Pl. 17, figs. 68, 69.

Young specimens of this species (and adults when not eroded) show a small area at each beak free from longitudinal riblets; but these riblets are developed upon the ridge toward the forward part of each valve, being finer there than upon the pleura. The lateral areas are generally very coarsely sculptured, as in pl. 17, fig. 68; I have seen only one specimen in which the lateral riblets are as fine as in pl. 18, fig. 59 of Vol. XIV.

Chiton lugubris Gld. (vol. XIV, p. 146), of which the types (Smiths. Inst. Mus., no. 2075) are before me, is merely a young *australis*, not eroded, and showing conspicuously the smooth, microscopically granulate space around each beak. As one of the type specimens is dismembered and the other is curled, I have figured a young *australis* from the Academy collection to illustrate the form; the specimen selected being almost exactly like the type. *I. lugubris* will therefore be added to the synonymy of *australis*.

Genus CALLISTOCHITON Cpr. (Vol. XIV, p. 260).

C. DECORATUS Cpr. Pl. 16, fig. 54. (Vol. XIV, p. 269).

In some specimens of this species the smooth area at the jugal ridge is decidedly narrower than in the typical form, represented on pl. 58, fig. 18 of Vol. XIV, and the lateral ribs are more elevated, acute, and indistinctly granulated, the girdle being tessellated buff and brownish. Central areas buff, lateral areas olivaceous. Posterior rib of each valve split by a shallow, small sulcus; and in the individual described (Mus. Smiths. Inst., 58897) there are 12 ribs on the head valve. Surface lusterless. Sculpture of pleura coarser and sharper.

The differences above noted are presented by a specimen from San Diego, collected by Hemphill. Although the divergence from the

type is considerable, yet it seems insufficient for specific discrimination, although possibly grounds may be found for separating the San Diego shells as a northern race of the Lower Californian *decoratus*.

The gill-row in this specimen is as long as the foot, as usual in *Callistochiton*.

Genus NUTTALLINA Cpr. (Vol. XIV, p. 277).

N. PICEOLUS Shuttleworth. (Vol. XIV, p. 229).

This is no doubt a species of the subgenus *Middendorffia*, not an *Acanthopleura*.

Family CHITONIDÆ Pilsbry.

Genus CHITON L.

Chiton L.; Man. of Conch. xiv, p. 149.

Amaurochiton THIELE, Das Gebiss der Schnecken, ii, p. 362 for *C. olivaceus, cumingi, striatus, tenuistriatus*.

Chondroplax THIELE, *t. c.*, p. 363, for *C. granosus* and *stokesi*.

Diochiton THIELE, *t. c.*, p. 364, for *C. albolineatus*.

Pœciloplax THIELE, *t. c.*, p. 365, for *C. glauca* Gray,=*quoyi* Desh.

Sypharochiton THIELE, *t. c.*, p. 365, for *C. pellisserpentis*.

Georgus THIELE, *t. c.*, p. 366, for *C. rusticus* Dh. and "*nigrovirencens*" Blv.

Clathropleura (Tib.) THIELE, *t. c.*, p. 367, for *C. siculus* Gray and *affinis* Iss.

Anthochiton THIELE, *t. c.*, p. 377, for *C. tulipa* Q.

The "genera" enumerated above are, in the opinion of the writer, founded on merely specific characters, or at most they indicate only groups of species of less value systematically than the groups called "sections" in this work. Such multiplication of generic synonyms seems unnecessary and positively harmful.

C. SQUAMOSUS Linné. (Vol. XIV, p. 155.)

Add to synonymy: *Chiton spengleri* BLAINV., Dict. Sc. Nat. xxxvi, p. 538, and *Chiton pictus* BLAINV., *l. c.*, p. 541 (incorrect description of teeth); this is *C. cymbium* of the Museum collection, according to Blainville.

C. PUSIO Sowerby.

This species was described under *Ischnochiton* in Vol. XIV, p. 133, but is is probably a true *Chiton*, and the same as *C. murrayi* Haddon, vol. xiv, p. 161.

C. DISCOLOR Souverbie. (Vol. XIV, p. 175). Pl. 10, figs. 3, 4 (this vol.)

The reference to plate is incorrect in the text. Synonym is: *Lepidopleurus ectypus* ROCHEBR., Bull. Soc. Philom. 1883–1884, p. 37. A well grown specimen before me measures 28 mill. long, 16 broad. It is closely allied to *C. canaliculatus* Q. & G.

C. RUBICUNDUS Costa. (Vol. XIV, p. 182).

Has been reported from the Balearic Is. by Hidalgo. The name *C. scytodesma* should be removed from the synonymy. Scacchi's description in Cat. Reg. Neapolitani p. 9, is insufficient for identification, but suggests *Callochiton lævis* rather than this species.

C. SULCATUS Wood. (Vol. XIV, p. 191.)

The authority "Sowerby" was wrongly written in the text.

Genus TONICIA Gray (Vol. XIV, p. 194.)

Add to synonyms: *Lucia* GLD., Otia Conch, p. 242 (preoc.).— *Lucilina* DALL, Proc. U. S. Nat. Mus. 1881, p. 284, 287. (Type of both, *C. confossus* Gld.).

Toniciopsis (in part) THIELE, Das Gebiss der Schnecken, ii, p. 371, for *picta* Rve., *maillardi* Dh., *wahlbergi* Kr.

If a separate subgeneric name is needed for the Oriental Tonicias with posterior mucro (division 3, of my arrangement, vol. xiv, p. 206), we may use *Lucilina; Toniciopsis* becoming a synonym. The latter was founded upon a species of *Tonicia* (Lucilina), a species of *Onithochiton*, and a *Plaxiphora!* This instance well shows the fatuity of founding genera upon slight variations of a single organ, as Thiele has done.

TONICIA LINEOLATA (Fremb.) Hutton, Manual of the New Zealand Mollusca, 1880, p. 114, reported from Dunedin, Auckland Islands and Campbell Island, is not likely to be the Chilian form described in Vol. XIV, p. 198.

T. INSCULPTA Souverbie. Pl. 10, figs. 10, 11.

Shell oval, subdepressed, obtusely carinated, having flat tubercles, and sculptured with depressed points; mainly of a green color. Tubercles subtriangular, depressed and scale-like, but little pronounced on the anterior valve, where they are arranged in rays, and extending along the diagonal line of the intermediate valves, with a

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few longitudinally arranged on the pleura. Triangular punctures elongated, as if engraved with the point of a burin, largest and sparsely distributed on the central areas, and on the lateral areas radially grouped among the rays of tubercles. Posterior valve obtusely umbonated, carinated on each side. Pale flesh colored maculated with dark green, the spots regularly placed, nearly covering the second valve and sides of the fifth and last valves; on the rest of the surface smaller, hardly noticeable, and scattered. Girdle rather wide, nude, reddish.

Length 10, width 5 mill. (*Souv.*)

Island of Art, New Caledonian Archipelago, one specimen in Bordeaux Mus.

Chiton insculptus Souv., Journ. de Conch. 1866, p. 248, t. 9, f. 5. Not *Ch. insculptus* Ad.—*Chiton montrouzieri* Souv., *l. c.*, 1873, p. 287.

This species is extremely near to *T. confossa* Gould. It was described from a single specimen which may not be adult.

Adams' *C. insculptus* being a typical *Chiton* (vol. xiv, p. 177), the change of name proposed by Souverbie becomes unnecessary.

T. floccata Sowerby. Pl. 14, figs. 3, 4.

Shell oval, depressed, narrowed in front; pale tawny maculated with black, brown, green and rose color. End valves radially sulcate. Median valves with a single rib on each side; the central areas longitudinally sulcate, lateral areas granulated, margins serrated. Terminal valve obtusely elevated. Margin red or brown, banded with white patches and dots.

Length 20, breadth 11¼ mill. (*Sowb.*)

Cagayan, Misamis, Island of Mindanao, Philippines (Cuming.)

Chiton floccatus Sowb., P. Z. S. 1841, p. 104.—Reeve, Conch. Icon. iv, f. 117.

This species is found at Mindanao under stones at low water, and at Calapan on small stones at a depth of 15 fms. The margin is sprinkled with white patches resembling flakes of snow, on a reddish-brown ground. (*Sowb.*)

Carpenter gives the following descriptive notes on the types: shell moderately elevated, oval. Jugum not sharp, more or less variegated with chestnut-brown, olive, pink and ashy. All of the valves are somewhat thrown forward, with blunt beaks; jugal areas not defined

except by color-stains, the ribs converging and meeting (Λ-like) forward; central areas having about 14 sharp, rather distant riblets on each side, the intervals quincunically granulated; lateral areas not much raised and small, the diagonal rib running out to the posterior end of the corner, the sutures deep and rounded; diagonal rib nodulous; sutural rib much stouter, with larger grains, the space between having metallic dots, [eyes], and often grains intercalated. Posterior valve having the mucro elevated at a slightly obtuse angle one-fifth of the valve's length from the posterior end. Interior: anterior valve with 8, median valves 1–1, posterior 10 slits; teeth rather conical and thrown forward in the tail valve; and viewed from behind the tooth-row curves upward in the middle, and the teeth are smaller and closer there; the teeth are sharp, and slightly pectinated outside; the anterior and side teeth are smooth. Sinus flat and deep, with about 16 teeth. Girdle having a few scattered hairs, densely and very minutely papillose.

Length 20, breadth 11 mill.; divergence 118°.

This species belongs to the group of *T. suezensis*, *nigropunctata* and *fortilirata* (vol. xiv, p. 206), characterized by the posterior mucro, strong longitudinal sulcation of the central areas, and the slightly asperulate or downy girdle.

Genus ACANTHOPLEURA Guild. (Vol. XIV, p. 213).

Add to synonyms: *Rhopalopleura* THIELE, Das Gebiss ii p. 373 for "*Chiton aculeatus* L."

A. SPINIGER Sowb. (Vol. XIV, p. 221).

The citations of Angas and Tapparone-Canefri of New South Wales localities for *Chiton "piceus"* (vol. xiv, p. 226) refer to *Liolophura gaimardi*.

Undetermined species.

ACANTHOPLEURA RAWAKANA Rochebr. Shell ovate, wide, gray, with spots and lines of blue and red, and scattered black dots. Anterior valve and posterior part of the posterior valve concentrically pustulate. Intermediate valves having the lateral areas multisquamose; central areas very minutely pitted. Marginal ligament rather wide, having acute red spines. Length 19, breadth 12 mill. (*Rochebr.* in Bull. Soc. Philom. 1881–'82, p. 195.)

Rawak, Papua. Rare. Mus. Paris.

A. TESTUDO Spengler. This name is proposed by Spengler for the Red Sea form, which I have treated in vol. xiv, p. 222 as a variety of *A. spiniger*. This name cannot be adopted in preference to the specific name *spiniger*, because Spengler gave no description whatever. See Skrivter af Naturhistorie-Selskabet, iv, p. 78, and Mal. Bl. xvii, p. 111, 112. The "*Ch. aculeatus*" of Spengler is *A. spiniger*. Rochebrune's name *balansæ* was applied to the Red Sea *Acanthopleura*, but it has not been acceptably defined.

Family *ACANTHOCHITIDÆ* (Vol. XV, p. 6).

Genus ACANTHOCHITES Risso.

Add to generic synonyms: *Mecynoplax* THIELE, Das Gebiss der Schnecken ii, p. 393, for *acutirostratus* Rve. [?] from Hakodate!

Genus AMICULA Gray, (*Antea*, p. 42).

Add to synonyms: *Stimpsoniella* CPR., Bull, Essex. Inst. 1873, p. 155; Ann. Mag. Nat. Hist. (5) xiii, p. 122, 1874.

APPENDIX II.

INSUFFICIENTLY DESCRIBED CHITONS, AND SPECIES OF UNKNOWN GENERIC POSITION.

In a group so prolific in specific and varietal forms as the Chitons, we expect to find a certain number of descriptions of supposed new forms so inadequate that their recognition is extremely difficult or impossible. In most groups we find that the earlier authors, not appreciating the niceties of modern species discrimination, having but a few out of the multitude of specific forms, and being without precise technical language, have contributed the greater part of such literature. In the Polyplacophora the bulk of this descriptive matter has been a recent growth, and is in large part due to the labors of Dr. A. T. de Rochebrune, Aid Naturalist at the Paris Museum (Jardin des Plantes). The various memoirs by Rochebrune describe a multitude of supposed new forms, but so incompletely that only in rare instances can they be recognized, and even the genus can scarcely ever be ascertained from his descriptions. In his use of the generic terms of Gray and others he has been most unfortunate, employing them correctly in but few cases. After much study I have ascertained the fundamental principles of Dr. Rochebrune's classification of Chitons to be as follows:

(1). Species with naked girdle he calls *Tonicia*.

(2). Species with scaly girdle are called *Lepidopleurus* if the scales are small, *Gymnoplax* if they are larger.

(3). Species with spinose or hairy girdles are classed—

a. as *Acanthochites* if tufts are present.

b. as *Chætopleura* if girdle has hairs.

c. as *Acanthopleura* if girdle has spines.

The names *Schizochiton*, *Leptochiton*, *Onithochiton*, etc. are used in a variety of senses, or with no sense at all; but in no case, so far as I can learn, for the groups correctly so termed. Rochebrune's types are in the Paris Museum.

There are also included herein a few species carefully described by well-known authors, but without reference to the internal characters. These are mostly quite recognizable specifically, but they require re-examination to ascertain their generic affinities.

The species are grouped geographically.

1. *Northern Europe and N. Atlantic species.*

Onitochiton [*sic*] rhygophilum Rochebrune. Shell ovate, carinated, ochraceous; anterior valve smooth; posterior part of the posterior valve and lateral areas of intermediate valves very minutely granulated; central areas lacunose at the sides. Marginal ligament somewhat wide, pale rufous. Length 17, breadth 10 mill. (*Rochebr.* in Bull. Soc. Philom. de Paris, 1883–1884, p. 32).

Coasts of Norway (Coll. Petit), rare—Paris Museum.

Chiton rarinota Jeffreys. Vol. XIV, Pl. 4, fig. 86.

Shell oblong-oval, arched, rather thin and glossy: plates broader in the middle than at the sides; lateral areas indistinct. Sculpture consisting of white tubercles, which are few in number and irregularly scattered; these are round in the middle of the shell, but become more raised and oval at the sides; under a microscope can be detected numerous and close-set lines or striæ, which are arranged lengthwise; colour whitish; beaks none, except on the tail-plate, where they are nearly circular: inside glossy. (*Jeffr.*)

Length 2½, breadth 1¼ mill.

North Atlantic.

C. rarinota Jeffr., Moll. of 'Lightning' and 'Porcupine' Expeditions, in P. Z. S. 1882, p. 668, t. 50, f. 1.

Although this is a very small species, and might be regarded as the young of some other species, I must observe that I have carefully compared both specimens with the young of all other European species of Chiton known to me, and some specimens of which last mentioned species are much smaller than those which I have now described. The peculiar character of having so very few and scattered tubercles is not presented by any other of those species. The girdle is membranous and thin. (*Jeffr.*)

CHITON SCABRIDUS Jeffreys.

Shell oval-oblong, somewhat depressed, of a dull hue, plates narrow; all except the ternimal ones are nearly equal in width; the lateral compartments in each valve are indistinct and not raised above the middle portion. Sculpture consisting of minute tubercles arranged in several longitudinal rows, which are distinctly defined in the middle, and radiate or diverge to the margin on the lateral and terminal spaces. There is no central ridge, color yellowish-brown; beaks inconspicuous, except on the tail plate. Inside glossy, furnished toward each side of all the plates except the head plate with obtusely triangular leaves which serve to interconnect the plates, Margin slightly and irregularly notched. Length ·2125, breadth ·125 inch. (*Jeffr.*)

Goodrington, Torbay; Jersey; England.

Jeffreys, in Ann. Mag. N. H. (5), vi, 1880, p. 33.

This may be a *Hauleya*, as Jeffreys compares it *H. hanleyi* and *mendicarius*.

2. *Mediterranean and West African species.*

CHITON PHASEOLINUS Monterosato. Shell narrow, the valves obtuse, not carinated; lateral areas and end valves not striated, but concentrically rugose; median areas longitudinally 2–3 striate. Girdle subimbricated with most minute scales.

Length 15, width 7·5 mill.

Naples (A. Costa); *Palermo* (Monts.)

Chiton rubicundus var. phaseolinus MONTS., Nuova Rivista della Conch. Medit., p. 21, 1875.—*Chiton phaseolinus* Monts., CARUS, Prodr. Faun. Medit. ii, pt. 1, p. 179.

Known to me only by the above description.

CHITON FURTIVUS Monterosato. Shell minute, flat, wide, smooth, the lateral areas concentrically and subquadrately sculptured, little elevated; girdle covered with a delicate roughness.

Length 7·5, width 4·5 mill.

Palermo, in 20–30 fms. (Monts.)

Chiton furtivus MONTS., Not. Conch. Médit., p. 29; Nuova Rivista etc., p. 21; Journ. Conch. 1878, p. 147.—CARUS, Prodr. Faun. Med. ii, p. 179.

CHITON MINIMUS Monterosato. Shell small, convex, elongated; surface puncticulate-perforate; lateral areas little elevated. Girdle, seen under a lens, most minutely and irregularly scaly.

Length 5, width 3 mill.

Gulf of Lyons (Martin); *Marseilles* (Marion); *Palermo* (Monts.); *Dalmatian littoral* (Brusina).

C. minimus Monts., CARUS Prodr. Faun. Med. ii, p. 180.

CHITON PACHYLASMÆ (Seguenza MS.) Monterosato. Shell minute, rough, the lateral areas strongly elevated; posterior valve 7-radiate, anterior valve scabrous. Girdle very minutely gravelly under a lens. Length 5–6, width 3·5 mill.

Straits of Messina (Seguenza).

Ch. pachylasmæ (Seg.) Monts., CARUS, Prodr. Faun. Med. ii, p. 180.

CHITON STIGMA O. G. Costa, Cat. Sist. e Ragionato de' Test. della due Sicil., pp. i, iv, t. 1, f. 5 (1829). A larval shell!

GYMNOPLAX SENEGALENSIS Rochebr. Shell oblong ovate, carinated; rather whitish with sparse rufescent spots. Anterior valve smooth. Anterior area of the posterior valve and central areas of the intermediate valves longitudinally deeply sulcate; lateral areas smooth, bi-lirate at the base. Marginal ligament wide, granose, pale rose. Length 24, width 10 mill. (*Rochebr.* in Bull. Soc. Philom. Paris, 1880–'81, p. 118; *Lophyrus senegalensis* Rochebr., Journ. de Conch. 1881, p. 42.)

Rocks of Dakar; Promontory of Cape Verde; Madeline Is. Rare. Paris Mus.

Probably a synonym of *Chiton canariensis* Orb.

TONICIA GAMBIENSIS Rochebrune. Shell elliptical, wide, subcarinated, roseate painted with blackish spots; anterior valve and anterior part [sic] of the posterior valve radially granose; inter-

mediate valves having the lateral areas graniferous; central areas longitudinally most minutely granose-lirate, liræ undulating. Marginal ligament broad, corneous, glabrous, brown. Length 9, breadth 4 mill. (*Rochebr.* in Journ. de Conchyl. 1881, p. 43; and Bull. Soc. Philomath. 1880–'81, p. 118).

Cape St. Marie, W. Africa (Paris Museum.)

ACANTHOPLEURA QUATREFAGEI Rochebr. Shell subelongated, complanate; pitchy, marbled with brown and whitish spots. Anterior valve, anterior part of posterior valve and lateral areas of the intermediate valves obscurely granose. Lateral areas very densely vermiculate. Marginal ligament thick, corneous, black, beset with obtuse, short, whitish and rufescent spikes. Length 26, breadth 12 mill. (*Rochebr.* in Bull. Soc. Philom. 1880–'81, p. 117; Journ. de Conch. 1881, p. 44).

Point of Mammelles; Joalles; *Rufisque* (Rochebrune); *Table Bay, Cape of Good Hope* (Verreaux). Mus. Paris.

Possibly a *Nuttallina*

LEPIDOPLEURUS SERERORUM Rochebr. Shell small, ovate pellucid, ashey; anterior valve and posterior part of the posterior, bicostate, ribs thick, concentric; intermediate valves having the lateral areas thick, transversely sulcate, subpectinated below. Marginal ligament red, scaly, scales very minute. Length 11, breadth 6 mill. (*Rochebr.* in Bull. Soc. Philom. 1880–'81, p. 118).

Bank of Argain, W. Africa (Mus. Paris.)

3. *South African species.*

ONITHOCHITON ALVEOLATUM Rochebrune. Shell ovate elongate, rotund, gray-greenish, anterior valve, posterior part of posterior valve and lateral areas of the intermediate valves radiately striated, the striæ cut across; central areas most minutely reticulate-alveolate. Marginal ligament rather wide, shistaceous. Length 24, breadth 14 mill. (*Rochebr.*, Bull. Soc. Philom. de Paris, 1883–1884, p. 32).

Cape of Good Hope, rare; Paris Museum.

I suppose this is one of the S. African Ischnochitons.

ACANTHOPLEURA AFRA Rochebr. Shell ovoid, wide, blackish, umbonate, umbones marked with a wide blue band. Anterior valve, posterior part of the posterior valve and lateral areas of the intermediate valves regularly and radially strongly granulated. Central

areas smooth, rugulosely granulated at the sides. Marginal ligament rufous, beset with saffron colored setæ. Length 59, width 44 mill. (*Rochebr.* in Bull. Soc. Philom. 1881–'82, p. 192).

Cape of Good Hope (Verreaux); *Madagascar* (Cloué). Not common. Mus. Paris.

GYMNOPLAX ANAGLYPTUS Rochebr. Shell ovate, subcomplanate; olivaceous, painted with brown striæ. Anterior valve, posterior part of the posterior valve, and lateral areas corrugated. Central areas minutely sulcated at the base, the sulci incurved; at apices very delicately ("mollissime") striated. Marginal ligament rather wide, bluish-gray ("schistaceo"). Length 15, width 10 mill. (*Rochebr.* in Bull. Soc. Philom. Paris, 1883–'84, p. 33).

Cape Good Hope. Rare. Mus. Paris.

GYMNOPLAX MELANOTREPHUS Rochebr. Shell ovate, subcarinate, intense chestnut colored. Anterior valve, posterior part of the posterior valve and lateral areas of the intermediate valves radially lyrate, the lyræ acute, obtusely dentate. Central areas very subtly rugose. Marginal ligament rather wide, chestnut colored, regularly begirt with square orange spots. Length 15, breadth 10 mill. (*Rochebrune*, in Bull. Soc. Philom. 1883–'84, p. 34).

Cape of Good Hope. Rare. Paris Museum.

4. *Species from the Red Sea.*

ACANTHOPLEURA VAILLANTII Rochebr. Shell ovate elongate, wide; whitish painted with olivaceous spots. Anterior valve and posterior part of posterior valve granulose, and having scattered conic tubercles. Intermediate valves having the lateral areas covered with elongated black tubercles; central areas rugulose in the middle, anteriorly tuberculate. Marginal ligament wide, bearing whitish and green subelongated, conical spines. Length 43, width 32 mill. (*Rochebr.*, Bull. Soc. Philom. 1881–'82, p. 192).

Suez Canal (L. Vaillant). Quite common. Paris Mus.

TONICIA PTYGMATA Rochebrune. Shell subelongate, much elevated, obtusely carinated; whitish with pale chestnut spots and tawny lines; anterior valve radially striated; lateral areas and posterior area of tail valve strongly and deeply corrugated; central areas sculptured with lamellose and undulating sulci. Marginal ligament narrow, corneous, rufous. Length 21, breadth 13 mill. (*Rochebr.* in Bull. Soc. Philom. de Paris 1883–1884, p. 33).

Red Sea (M. Botta); Paris Museum.

LEPIDOPLEURUS BOTTÆ Rochebr. Shell elongated, carinated; olivaceous or whitish, painted with buff spots. Anterior valve, and posterior part of the posterior valve, radially widely sulcated. Lateral areas of the intermediate valves trisulcate; central areas longitudinally sulcate, the sulci broad, incurved, very delicately denticulate at the margin. Marginal ligament ashy, covered with minute scales. Length 11, breadth 5 mill. (*Rochebr.* in Bull. Soc. Philom. 1881–'82, p. 192).

Red Sea (Botta). Rare. Mus. Paris.

This may possibly be *Callistochiton heterodon*, but the description is too meager for identification.

LEPIDOPLEURUS CONCHARUM Rochebr. Shell ovate, carinated, waxen. Anterior valve, posterior area of the posterior valve and lateral areas of intermediate valves radially minutely striolate. Central areas sulcated, the sulci dentate. Marginal ligament small, waxen, painted with green spots. Length 9, width 6 mill. (*Rochebr.* in Bull. Soc. Philom. 1883–'84, p. 33).

Red Sea. Rare. Mus. Paris.

5. *Philippine Island species.*

C. CALIGINOSUS Reeve. Vol. XIV, pl. 37, figs. 9, 10.

Shell ovate; terminal valves and lateral areas of the rest radiately striated, striæ here and there bifurcated; central areas minutely reticulated. Olive variegated with black; posterior margins of the valves articulated with black. Ligament granosely coriaceous. The articulated painting along the posterior edges of the valves is rather a conspicuous feature in this species. (*Rve.*)

Negros, Philippines.

C. caliginosus RVE., Conch. Icon., t. 25, f. 172 (May, 1847).

Probably belongs either to *Chiton s.s.* or to the section *Lepidozona* of *Ischnochiton.*

CHITON BIRADIATUS Sowb. Shell oval, subelongated subdepressed, obtusely angulated. Central areas minutely scabrous-sulcated; lateral areas subelevated, with two bifid, very irregularly moniliform ribs on each side; terminal areas radially rugose-costate; margin most minutely granulose. Color pale tawny, maculated with gray. Margin gray banded. Length ·60, width ·35 inch. (*Sowb.* in P. Z. S. 1843, p. 102).

Dumaguete, Island of Negros, Philippines (Cuming).

This species differs from *Ch. janeirensis* in having the lateral ribs bifid, and the sculpture generally more minute. (*Sowb.*)

6. *New Caledonian species.*

CHITON OBSCURELLUS Souverbie. Pl. 10, figs. 8, 9.

Shell ovate-oblong, narrower in front, the back carinated; anterior valve radially delicately tuberculate, posterior valve scarcely umbonated, the beak subapical. Anterior margins of the lateral areas a little raised. *Entire surface of all valves most minutely, densely granose-scaly. Color brown ferruginous, lusterless, with a line articulated with black and white in front of the diagonal border of each lateral area.* Girdle most minutely scaly.

Length 5, breadth 3½ mill. (*S. & M.*)

Island of Art, New Caledonian Archipelago.

Chiton obscurellus SOUV., Journal de Conchyl. 1866, p. 251, t. 9, f. 4.

The generic position of this species is quite unknown to me. It was described from a single specimen, now in the Bordeaux Museum.

CHITON SUBASSIMILIS Souverbie. Pl. 10, figs. 1, 2.

Shell ovate-oblong, the back carinated. End valves and lateral areas sculptured with numerous radii, more or less anastomosing and subgranulose, being decussated by growth-lines. Central areas longitudinally traversed by well-impressed, subflexuous, suboblique grooves, deeper and more widely spaced toward the outer edges, becoming obsolete toward the median carina, which is smooth; visibly crossed by fine growth-striæ. Entire surface extremely finely shagreened when seen under a lens. Color dark green, with numerous longitudinal white lines on the central areas, and small spots of the same color on the end valves. Girdle scaly-coriaceous, with large alternate blotches of olivaceous and ashen.

Length 20, breadth 9½ mill., excluding girdle. (*Souv.*)

Island of Art, New Caledonian Archipelago.

Chiton subassimilis SOUV., Journ. de Conch. 1866, p. 254, t. 9, f. 2.

Described from a single example, which is in the Bordeaux Museum. Souverbie compares it to *assimilis* Reeve.

CHITON TUBERCULOSUS Souverbie. Pl. 10, figs. 5, 6.

Shell ovate-oblong, the back obtusely carinated; grayish-buff, with a dull white spot on each side of the carina. End valves margined

with two parallel series of strong tubercles, radially arranged, the inner series hardly noticeable in the posterior valve; lateral areas of the intermediate and posterior valves bordered with a single series of similar tubercles; central areas longitudinally impressed-sulcate on each side; the entire surface of valves most minutely asperulate. Girdle scaly, grayish, maculated with greenish-ashen.

Length 6¼, breadth 3½ mill. (*Souv.*)

Island of Art, New Caledonian Archipelago.

Chiton tuberculosus Souv., Journ. de Conch. 1866, p. 251, t. 9, f. 3.

Described from one specimen, which is in the Bordeaux Museum. Its generic characters are not known.

Lepidopleurus noemiæ Rochebr. Shell ovate elliptical, obtusely carinated, whitish, with wide ochraceous spots everywhere. Anterior valve, lateral areas of intermediate valves and posterior area of posterior valve, circularly, deeply waved, and ornamented with regularly placed bead-like tubercles; central areas smooth. Marginal ligament rather narrow, whitish, marked with distant square red spots. Length 17, breadth 10 mill. *New Caledonia*, M. Belligny. (*Rochebr.* in Bull. Soc. Philom. 1883–'84, p. 38).

Gymnoplax ludoviciæ Rochebr. Shell ovate, carinated, a little obtuse; greenish variegated with white and blue spots. Anterior valve and posterior area of posterior valve radially tuberculate, the tubercles flattened. Intermediate valves having the lateral areas imbricately sulcate and bordered by a beaded line; central areas most minutely striated. Marginal ligament rather wide, shining olivaceous. Length 24, width 17 mill. *New Caledonia.* Rare. Mus. Paris. (*Rochebr.* in Bull. Soc. Philom. 1883–'84, p. 38).

Gymnoplax alphonsinæ Rochebr. Shell ovate-elliptical, carinated, very pale green. Anterior valve and posterior area of the posterior valve radially costate, the ribs unequal, somewhat beaded. Intermediate valves having the lateral areas 5-ribbed, the ribs wide, the outer much roughened at the margin. Central areas sulcate, smooth at the apices. Marginal ligament narrow, margaritaceous. Length 28, breadth 15 mill. *New Caledonia* (Belligny). Rare. Mus. Paris. (*Rochebr.* in Bull. Soc. Philom. 1883–'84, p. 38).

Gymnoplax rhynchotus Rochebr. Shell elongated, intensely carinated, pale rose color. Valves rostrate at the apices; anterior

valve and posterior part of the posterior valve smooth; intermediate valves having the lateral areas swollen, smooth, delicately rugate internally; central areas lamellose. Marginal ligament wide, roseate. Length 14, width 9 mill. *New Caledonia.* Rare. Paris Museum. (*Rochebr.* in Bull. Soc. Philom. 1883–'84, p. 39).

7. *Australian species.*

HANLEYA VARIABILIS Adams and Angas.

Shell oblong, whitish, variegated with blackish-brown. Valves broad, carinated; dorsal areas longitudinally densely costate, the ribs closely pustulose; lateral areas but slightly elevated, transversely undulately costate, the costæ closely pustulose. Girdle, having short white corneous spicules at the margin, and bunches of pale spicules.

Length 16, breadth 10 mill. (*Ad. & Ang.*).

Yorke's Peninsula, S. Australia (Coll. Angas), under stones at low water.

AD. & ANG., P. Z. S. 1864, p. 194.—ANGAS, P. Z. S. 1865, p. 188.

Carpenter surmises that this may be a second species of *Angasia*, but this can hardly be the case, although the girdle characters suggest a superficial similarity. It may be a *Chætopleura* or even an *Acanthochites*.

LEPIDOPLEURUS LIRATUS Adams and Angas.

Shell small, elongated, convex; yellowish-brown, maculated with pale brown. End valves and lateral areas concentrically remotely sulcated, densely and minutely lirate, the liræ closely pustulose. Posterior valve elevated, lateral areas slightly elevated; median valves obtusely carinated in the middle; dorsal areas longitudinally lirate, the liræ closely pustulose. Girdle pale-brown, densely covered with minute scales.

Length 8, width 4 mill. (*Ad. & Ang.*)

Yorke's Peninsula, S. Australia, under stones at low water (Angas).

Lepidopleurus liratus H. AD. & ANG., P. Z. S. 1864, p. 192.—ANGAS *l. c.* 1865, p. 187.

The generic position of the species is unknown, but it may be an *Ischnochiton* of the *contractus* group.

LEPIDOPLEURUS VARIEGATUS Adams & Angas.

Shell oblong, convex; whitish, maculated with green and irregularly ornamented with brown, the spots closer at the sides. End valves minutely divaricately striated, at the margins radiately costate and concentrically sulcated. Median valves subcarinated; dorsal [central] areas minutely divaricately striated; lateral areas scarcely elevated, with a few tubercles, radially ribbed, at the margins concentrically sulcated, the interstices minutely granulated. Girdle pale brown, covered with close small scales.

Length 18, breadth 8 mill. (*Ad. & Ang.*)

Yorke's Peninsula, S. Australia, under stones at low water (Angas).

Lepidopleurus variegatus H. ADAMS & G. F. ANGAS, Proc. Zool. Soc. Lond. 1864, p. 192.—ANGAS, *l. c.* 1865, p. 187.

Generic characters unknown. Probably an *Ischnochiton* allied to *fruticosus, divergens*, etc.

CHITON COCCUS Menke. Shell elliptical, subdepressed, thin, pellucid, ashey. Terminal valves with granose-nodulose rays, the anterior 11, posterior 10; other valves with the median areas granulose, marked with a brown spot in the middle, roseate posteriorly; lateral areas on each side furnished with a pair of strong radiating granose ribs. Girdle very subtly granulose, hoary variegated with dark spots. Length 4, breadth 2 lines. (*Mke.*, in Zeitschr. f. Mal. 1844, p. 62).

North-west coast of New Holland, on Tridacna elongata.

This may prove to be a *Callistochiton*.

GYMNOPLAX URVILLEI Rochebr. Shell ovate elongated, greenish. Anterior valve and lateral areas of the intermediate valves granose, the grains generally subconical. Central areas strongly transversely sulcate, the sulci angulose. Posterior valve granulose. Marginal ligament wide, gray, with a minutely reticulated clothing of rhombic scales. Length 27, width 15 mill. (*Rochebr.* in Bull. Soc. Philom. Paris, 1880–'81, p. 121).

King George Sound [*S.-W. Australia*]. Rare. (Quoy & Gaimard). Mus. Paris.

Rochebrune thinks that the "Port du roi Georges" is in Polynesia!

Chætopleura biarmata Rochebr. Shell ovate oblong, pale rose. Anterior valve and posterior part of the posterior valve radially granate. Intermediate valves having the central areas covered with straight beaded lines; lateral areas longitudinally papillose all over with papillæ or obtuse conic granules. Marginal ligament gray, with scattered whitish setæ. Length 24, breadth 14 mill. (*Rochebr.* in Bull. Soc. Philom. 1881–'82. p. 195).

King George Sound (Quoy & Gaimard). Rare. Paris Mus.

This seems to be a *Chætopleura.*

Lepidopleurus fodiatus Rochebr. Shell ovate elongated, fuscescent. Anterior valve minutely radially sulcate, the sulci interrupted by concentric lines. Intermediate valves having the central areas ornamented in front with minute undulating sulci; at the sides with many pits ("lateraliter multicavatis"), the pits minute, elliptical or rounded. Lateral areas longitudinally strongly sulcate and sculptured with thick concentric ribs. Anterior part of the posterior valve multicavate, posterior part radially sulcate. Marginal ligament rather wide, brown, scaly; scales minute, lenticular, imbricating. Length 35, width 18 mill. (*Rochebr.* in Bull. Soc. Philom. 1880–'81, p. 120).

Australia (Verreaux). Quite rare. Mus. Paris.

Schizochiton nympha Rochebr. Shell elongated, very narrow, obtuse in front and behind, rounded above; schistaceous cinnamon color marked with white spots. Anterior valve smooth; posterior elliptical, hastate; intermediate valves having the lateral areas thick, much raised, triangular. Marginal ligament narrow, schistaceous. Length 32, width 11 mill. (*Rochebr.* in Bull. Soc. Philom. 1883–'84, p. 36).

Island of King (Péron & Lesueur). Very rare. Mus. Paris.

Chiton tectum Blainv. Body oval, short, depressed, strongly carinated in the middle; girdle quite narrow, covered with small very numerous and much crowded scales. Shell large, 8-valved, the end valves ornamented with subtuberculate rays; lateral areas of intermediate valves with 4 or 5 tuberculate rays; the central areas with some coarse straight and flat channelling. Color gray-whitish, with a series of pretty blue spots around the girdle. This pretty species, of which one example exists in the Museum, probably lives in the seas of New Holland. (*Blainv.* in Dict. Sc. Nat. xxxvi, p. 539).

This species and the next four probably belong to the restricted genus *Chiton*.

CHITON MULTIMACULATUS Blainv. Body oval, but little elongated, the girdle very narrow and finely scaly. Shell large, having 8 narrow valves. Median areas of the 6 intermediate valves smooth or having growth-lines only. Lateral areas with 6–8 granulous rays. End valves with the rays less granulous, straight and diverging from summit to circumference. Anterior insertion-plate divided into 15 teeth; the posterior into 11; all pectinated. Color of the shell green within, and agreeably varied with interrupted lines of a black-violet on a gray ground outside. Three black spots on the posterior margin of the lateral areas. (*Blainv.* in Dict. Sc. Nat., p. 540).

Port of King George, Australia.

CHITON CLYPEUS Blainv. Shell short, oval, swollen; the lateral areas and end valves rayed from summit to circumference. Median areas nearly channelled longitudinally. General color greenish-brown, with small circular spots of aqua-marine or varied with yellow or greenish lunules. (*Blainv. l. c.*, p. 540).

New Holland.

CHITON TESTUDINARIUS Blainv. Body oval, swollen, convex, little or not carinated. Girdle covered with very small scales. Shell large, quite smooth and shining. End valves radiated above and especially below by grooves. Plate of insertion divided into 12 strongly pectinated teeth. Lateral areas of the intermediate valves indicated only by a slight carina, a little marked with lines of growth. General color greenish, with spots of darker at the border; the shell tortoise-shell brown, varied with some lighter spots. (*Blv.*, Dict. Sc. Nat. xxxvi, p. 540).

Habitat unknown, but probably Australia.

CHITON ELEGANS Blainv. Shell oval, of the same form as the preceding species, but more carinated; composed of 8 valves of nearly the same proportions; but the strongly elevated lateral areas are smooth as the median area; the end valves equally smooth. Color varied with red, black and dull white above, greenish-white within. (*Blainv.*, Dict. Sc. Nat. xxxvi, p. 540).

New Holland.

This may very likely be *Chiton tulipa* Q. & G., a South African species. It may be mentioned in this connection that Angas has

reported *tulipa* from Port Lincoln, P. Z. S. 1865, p. 186. His species can hardly be the true *tulipa* however.

CHITON ELONGATUS Blainville. Body quite long, narrow, convex, rounded equally at the two extremities, not carinated; the end valves sensibly smaller proportionally than in the preceding species, but still alike. Anterior valve tuberculose throughout the greater part of its extent, its border of insertion divided into 15 very short teeth, not pectinated; posterior valve short with 11 teeth, not at all pectinated; the lateral areas of the intermediate valves are quite perceptible; the margin subsquamose; color extremely variable, green on each side, the middle of the back yellowish-white. (*Blainv.*, Dict. Sc. Nat. xxxvi, p. 542).

Seas of Australia (Péron & Lesueur).

Apparently an *Ischnochiton*, but certainly not determinable.

CHITON LINEOLATUS Blainv. Body oval, quite long, the lateral areas of the intermediate valves less distinct than in the preceding species [*C. pictus* Blv.] and having numerous striæ at the borders; the scales of the girdle very small; the teeth of insertion not pectinated. Color varied with small longitudinal brown spots on a yellowish ground. (*Blainv l. c.*, p. 541.)

Island of King (Péron and Lesueur).

CHITON ALBIDUS Blainv. Body oval, thick, quite depressed; the girdle moderate and covered with short and very fine hairs. Shell large, 8-valved, proportioned nearly as in the preceding species [*C. hirtosus*]; the lateral areas of the intermediate valves a little indicated by a plane surface, and bordered by some striæ of growth. Anterior valve festooned on its margin of adhesion, divided into 9 large and entire teeth; the posterior valve without slits in its plate of insertion. Color of girdle uniform gray-brown; shell soiled white, or grayish below, of an aqua-marine green within. (*Blainv.*, Dict. Sc. Nat. xxxvi, p. 547).

Seas of the Island of King.

This is evidently a *Plaxiphora.*

CHITON COSTATUS Blainv. Body oval, wider in the middle than at the ends; girdle covered with quite long hairs. Shell subcarinated, 8-valved, the intermediate valves wider than the others, having the summit somewhat beaked, and the lateral areas separated from the median by a projecting rib. Anterior valve small, semicir-

cular, with 10 radiating ribs. General color of the shell yellowish, with brown spots, darker outside; white within. (*Blainv.*, Dict. Sci. Nat. xxxvi, p. 548).

Port of King George.

Probably a *Plaxiphora.*

Chiton hirtosus Péron. Body oval, wide, a little thick, depressed; the girdle moderate, covered with a multitude of little squamo-spinous tubercles. Shell of 8 valves, as in the preceding species [*Liolophura gaimardi*], but less long and broader; the marginal striæ of growth well marked, coarser; the summits of the areas little pronounced. Anterior insertion-plate very short, having 11 pectinated teeth; that of the posterior valve almost lacking, and entire. General color white, with irregular spots of brown on the girdle. (*Blainv.*, Dict. Sc. Nat. xxxvi, p. 546).

Seas of the island of King.

This may be an *Onithochiton* or a *Liolophura.*

8. *New Zealand species.*

Onithochiton filholi Rochebr. Shell ovate, wide, subcarinated; intense olivaceous concentrically ornamented with alternating buff and green lines. Anterior valve radially striated; posterior part of posterior valve lightly sulcate. Intermediate valves smooth on the central areas; the lateral areas most minutely radially striated, at the posterior part, strongly and concentrically bi-lirate. Marginal ligament wide, rubescent, silky. Length 29, width 18 mill. (*Rochebr.* in Bull. Soc. Philom. Paris, 1880–'81, p. 120).

Cooke's Strait (Filhol); common. Paris Mus.

Onithochiton decipiens Rochebr. Shell ovate, wide, subcarinate; olivaceous ornamented with concentric buff lines. Anterior valve radially striated; intermediate valves having the central areas smooth; lateral areas radially most minutely striated, laterally concentrically bi-lirate. Ligament wide, rubescent, silky. Length 29, width 18 mill. (*Rochebr.* in Bull. Soc. Philom. 1881–'82, p. 196).

Cooke's Strait (Filhol). Rare. Paris Mus.

Onithochiton neglectus Rochebr. Shell ovate-elliptical, subcarinated; brown with scattered buff or buffish maculæ. Anterior valve and posterior part of the posterior valve most minutely granulose. Intermediate valves having the central areas smooth, lateral

areas radially granose. Marginal ligament very wide, brown, satiny. Length 26, breadth 17 mill. (*Rochebr.* in Bull. Soc. Philom. Paris, 1880–'81, p. 120).

Wellington, New Zealand (Quoy & Gaimard). Rare. Paris Mus.

ONITHOCHITON ASTROLABEI Rochebr. Shell ovate; rubescent or green, conspicuously ornamented with concentric brown lines. Valves transversely rather narrowed, smooth. Lateral areas obscurely lirate, longitudinally and laterally lineated, the lines granulose. Marginal ligament wide, brownish, silky. Length 16, width 10 mill. (*Rochebr.* in Bull. Soc. Philom. Paris, 1880–'81, p. 120).

New Zealand (Quoy & Gaimard). Rare. Mus. Paris.

LEPIDOPLEURUS MELANTERUS Rochebr. Shell ovoid, rotund; chestnut painted with black spots. Anterior valve, posterior part of posterior valve, and lateral areas concentrically lyrate, the lyræ wide and flattened. Central areas most minutely tessellated. Marginal ligament narrow, dull rufous. Length 20, width 6 mill. (*Rochebr.* in Bull. Soc. Philom. Paris, 1883–'84, p. 37).

Campbell Island (Filhol). Common. Paris Mus.

LEPIDOPLEURUS CAMPBEL'LI [*sic*] Filhol. Length 17, width 8 mill. Color clear yellow, last valve larger than the first, covered with concentric lines, granulated. Lateral areas marked with concentric lines, having a concavity above. (Comptes Rendus, xci, p. 1095, 1880).

Campbell I.

TONICIA GRYEI Filhol. Very variable in coloration. First and last valves smooth in old individuals, granulose in the young. Intermediate valves marked with concentric lines, parallel on the anterior border of the valve (*l. c.*, p. 1095).

Campbell I.

PLAXIFORA CAMPBEL'LI [*sic*] Filhol. Allied to *P. biramosa* Quoy, but differing from it in the greenish color, by the last valve being covered with projecting concentric lines, and by the presence of very bushy bunches of hairs, not binary (*l. c.*, p. 1095).

Campbell I.

TONICIA RUBIGINOSA Hutton. Oblong; margin slightly tomentose; valves rather elevated, subcarinate, flattened on each side;

posterior margins straight, produced into an acute central point; lateral areas indistinct, the whole surface rather coarsely granular, the granules smaller on the back. Length ·45, breadth ·2 inch. Color pink, getting yellowish on the back. (*Hutton.*)

Cook Strait; Foveaux Straits (H. Filhol.) *New Zealand.*

Tonicia rubiginosa Hutton, Trans. N. Z. Inst. iv, p. 180 (1872); Man. N. Z. Moll., p. 114.—*Chiton rubiginosus* Swainson in coll.

Acanthopleura complexa Hutton. Oval; margin broad, velvety, with long spines scattered over it; valves depressed, flattened on each side, subcarinate; posterior margins not covering the next at the corners, rather convex, and pointed in the center; anterior valve with radiating moniliform ridges; lateral areas of intermediate plates granulose with two prominent, radiating, slightly curved ridges on each side; median areas with finely granular transverse waved lines, which pass imperceptibly into the larger lateral granulations; posterior valve small, like the intermediate ones; centers of valves punctate internally. Length, 1 inch; breadth ·5 inch. (*Hutton*).

Color:—margin reddish-brown, varied with darker; valves greyish, more or less varied with yellowish-white, yellow, or brown. (*Hutton.*)

Habitat unknown.

Acanthopleura complexa Hutton, Trans. New Zealand Institute iv, p. 181 (1872).

Hutton gives as synonyms "*Chiton aculeatus* Quoy and Gaim., *nec* Linn., *nec* Barnes. *Acanthopleura aculeatus* Gray, Dieff. N. Z., vol. ii, p. 245"; and in his Manual of N. Z. Moll., 1880, he places *complexa* in the synonymy of *Mopalia ciliata.* It is obvious that the first references are incorrect, Quoy's *aculeatus* being merely a form of *Acanthopleura spinigera*, with which species Hutton's description can in no way be made to agree. Whether *complexa* is a stray specimen of *Mopalia* (an exclusively North Pacific genus) can only be decided by an examination of the type. Von Martens has so affirmed (Zool. Rec. x, p. 151).

9. *West Indian species.*

Lepidopleurus corrosus Rochebr. Shell ovate, subcarinated; ashen, covered with minute black points. Anterior valve, posterior area of posterior valve and lateral areas of intermediate valves cor-

roded. Central areas covered with minute rod-like ("*virguliform*") striæ. Marginal ligament rather wide, white, ornamented with alternate ashen and orange spots. Length 15, breadth 8 mill. (*Rochebr.*, in Bull. Soc. Philom. 1883–'84, p. 36).

Island Cochino, Guadeloupe. Rare. Mus. Paris.

GYMNOPLAX SPICIFERUS Rochebr. Shell elongated, carinated; rose red striated with green lines. Posterior valve obtusely umbonated. Anterior valve, posterior part of the posterior valve, and lateral areas of the intermediate valves clothed with radiating beaded ribs. Central areas sculptured with branching sharp radial sulci. Marginal ligament narrow, white, ornamented with elongated green spots. Length 29, breadth 12 mill. (*Rochebr.*, in Bull. Soc. Philom. Paris, 1883–'84, p. 36).

Island Cochino, Guadeloupe. Rare. Mus. Paris.

ONITOCHITON [*sic*] PRUINOSUM Rochebr. Shell elongated, rotund; whitish ornamented with green dots and red spots. Anterior valve, posterior area of the posterior valve, and lateral areas of the intermediate valves regularly and concentrically sulcate; central areas sculptured with most minute, interrupted, subdichotomous striæ. Marginal ligament narrow, frosted. Length 27, breadth 10 mill. (*Rochebr.*, Bull. Soc. Philom. Paris, 1883–'84, p. 35).

Island Cochino, Guadeloupe. Quite common. Mus. Paris.

ONITHOCHITON MARGARITIFERUM Rochebr. Shell elliptical; pale rufous, painted with red spots. Anterior valve, posterior part of the posterior valve and lateral areas of the intermediate valves ribbed, the ribs tuberculate. Central areas minutely striated, striæ clothed with acute denticles. Marginal ligament very narrow, rufous. Length 10, breadth 5 mill. (*Rochebr.* in Bull. Soc. Philom. 1883–'84, p. 35).

Island Cochino, Guadeloupe. Rare. Mus. Paris.

10. *South American Species.*

CHITON GLAUCOCINCTUS Frembly. Pl. 10, fig. 12.

Shell oblong ovate, reddish, marked with alternate brown and greenish blue stripes. Valves eight, the first and last radiated; dorsal valves smooth, divided into two parts by a transverse ridge; posterior compartment grooved. Border broad, granulate, pink,

with brown spots. Length four-tenths of an inch, breadth one quarter. A solitary specimen of this elegant little shell was found at Valparaiso. I have, however, some doubts of its being adult. (*Fremb.*)

Valparaiso (Fremb.)

Chiton glaucocinctus FREMB., Zool. Journ. iii, p. 201, Suppl., pl. 17, f. 2 (1827).

Probably belongs to *Chiton s. str.*, but its generic position is not known. No other author has mentioned the species.

C. GRANULOSUS Frembly. Vol. XIV, pl. 24, fig. 5.

Shell narrow, granulated, granulations very fine; brown marbled, back acute, elevated; dorsal valves a little convex, not divided into compartments. Border narrow, covered with rather coarse granules of the same color as the shell.

Length 10, breadth 5 mill.

Concepcion Bay, Chili, on Calyptræa.

Chiton granulosus FREMBLY, Zool. Journal iii, p. 201, t. (suppl.) 17, f. 3 (1827).

Frembly's description is given above, and his figure copied on the plate. It is doubtful to what genus it should be referred, as the internal characters are not known.

C. CINGILLATUS Reeve. Vol. XIV, pl. 38, figs. 29, 30.

Shell ovate; valves smooth, surrounded near the margin with two or three concentric ridges; olive; ligament granosely coriaceous. The ridges at the end of the lateral areas form rows of concentric circles round the shell, which are very characteristic. (*Rve.*)

South America.

C. cingillatus RVE., Conch. Icon., t. 23, f. 160 (May, 1847).—*Mopaliopsis cingillata* THIELE, Das Gebiss, p. 393, 394.

The generic position of this species is doubtful. It may be either a *Lepidozona* or a *Chiton*. The locality given by Reeve is rather vague. Dr. Thiele has erected a new genus, *Mopaliopsis*, for this form, but as he characterizes it by the dentition alone, no light is cast upon the true systematic position of the species.

C. FIMBRIATUS Sowerby. Pl. 10, figs. 18, 19.

Shell oval, depressed, broad; central areas very finely granose-lineate; lateral areas and end valves very finely cancellated; girdle very finely granulate. Length 17½ breadth 12½ mill. (*Sowb.*)

The sculpture of this very pretty little species resembles the finest lace-work. The shell is rather flat and regularly oval; the central areas finely and granularly striated; on the lateral and terminal areas the radiating ridges are so regularly intercepted by concentric lines as to present a cancellated appearance. The margin is apparently smooth, but the lens discovers very minute sandy granulations; its color is brown banded with darker patches. The general color of the shell is cream-white variegated with red. (*Sowb.*)

Peru (Mus. Cuming.)

C. fimbriatus Sowb., Mag. of Nat. Hist. 1840, p. 293; Conch. Illustr., f. 137.

Known to me only by the above description and the figures.

Chiton dimorphus Rochebrune. Vol. XIV, pl. 27, figs. 13, 14 (x 3).

Shell ovate-rounded, umbonate, bright red. Anterior valve wide concentrically lineate. Posterior valve and central and lateral areas of the intermediate valves concentrically sulcate and most minutely puncticulate. The central and lateral areas have quadrangular pits at their intersections. Marginal ligament rufous, regularly striated with white lines. Length 14, breadth 10 mill. (*Rochebr.* in Zool. Cap Horn, p. 142, t. 9, f. 10).

Orange Bay, Patagonia.

Lepidopleurus cullereti Rochebrune. Vol. XIV, pl. 8, figs. 78, 79 (x 2).

Shell ovate elliptical, carinated, buff-tawny, maculated with chestnut. Anterior valve wide, rounded, minutely radiated; posterior rather small. Intermediate valves having the lateral areas punctate, margined with a smooth band; central areas most minutely transversely foveolate. Marginal ligament brown. Length 50, breadth 31 mill. (*Rochebr.*, Zool. Cap Horn, p. 140, t. 9, f. 9).

Orange Bay; Terra del Fuego. Not common.

Probably a *Chætopleura.*

Chætopleura dacrydigera Rochebr. Shell ovate, wide, subcarinated, olivaceous. Anterior valve, posterior part of the posterior valve, and lateral areas of the intermediate valves radially multigranose, the grains elevated, whitish, tear-shaped. Central areas longitudinally ornamented with beaded lines. Marginal liga-

ment rather wide, black, covered throughout with brown hairs. Length 22, width 14 mill. (*Rochebr.* in Bull. Soc. Philom. 1881–'82, p. 193).

Central America. Not common. Paris Mus.

Seems to be a true *Chætopleura.*

CHŒTOPLEURA VENERIS Rochebr. Shell ovate, carinated; sooty; anterior valve radially ribbed, the ribs wide, lacunose. Posterior valve small. Intermediate valves having the lateral areas bicostate, punctate. Central areas sulcate, the sulci imbricating, spinulose at the sides. Marginal ligament wide, sooty, clothed with white setæ Length 25, width 14 mill. (*Rochebr.* in Bull. Soc. Philom. 1883–'84, p. 34).

Punta Arenas, Patagonia (Mission Lebrun). Rare. Paris Mus.

CHŒTOPLEURA AHNNI Rochebr. Shell wide ovate, flattened, obtusely carinated, bluish-violaceous clothed throughout with brown striæ. Anterior valve rounded, 10-ribbed; posterior valve small, elliptical, subumbonated. Intermediate valves wide, the lateral areas very narrow and smooth, bounded by beaded ribs; central areas concentrically lyrate and most minutely striated. Marginal ligament wide, brown, clothed with long tawny hairs. Length 60, breadth 41 mill. (*Rochebr.* in Bull. Soc. Philom. 1883–'84, p. 34).

Punta Arenas Patagonia (Mission Lebrun). Common. Mus. Paris.

This and the preceding belong to the genus *Plaxiphora.* Rochebrune ignores them in his later publication on Cape Horn Polyplacophora.

SCHIZOCHITON HYADESI Rochebrune. Pl 14, figs. 6, 7.

Shell elongated, strongly carinated, dull whitish-cœrulescent. Anterior valve smooth, with 8 radiating ribs; posterior valve narrow, behind longitudinally sulcated, subemarginate, smooth, radiately bicostate. Intermediate valves having the median areas smooth, ornamented with articulated lines; central areas lineate-denticulate; lateral areas erect, isopleural, concentrically lineate, and strongly unicarinate in the middle. Girdle dull roseate, with sparse silky, shining hairs. Length 52, breadth 25 mill. (*Rochebr.* in Zool. Cap Horn, p. 132, t. 9, f. 1, 1889).

Terra del Fuego, in 20 meters.

Evidently a *Plaxiphora.*

CHITON CASTANEUS (Couthouy) Gld. Pl. 14, fig. 5.

Animal with the under side of the margin pale brick-red; foot narrow oval, dull olive color: head small, and laterally compressed; branchiæ pale ochreous-red, extending from the anterior margin of the foot to the rectum, leaflets conical, compressed, tapering to a fine point. (*Gld.*)

Shell minute, elongated-oval, slightly narrowed anteriorly, subcarinate, valves obtusely beaked, without distinct lateral areas, but marked throughout with coarse sublaminate ridges of increment, and covered with minute punctures arranged in quincunx; posterior valve with an obtuse umbo. Color externally deep chestnut, internally dull red. Margin narrow, thin, coriaceous, finely pubescent, having at the inner margin twenty-six fascicles of short, rigid, shining white setæ, looking like minute polished tubercles. (*Gld.*)

Length 7½, breadth 2½ mill.

Orange Harbor, Patagonia, on old shells and in tide pools. (U. S. Expl. Exped.).

Chiton castaneus COUTH. *MS.*, GOULD, U. S. Expl. Exped. Moll., p. 326, f. 411, *a-c* (not *Ch. castaneus* Wood, nor Q. & G.).—*Acanthochiton couthouyi* ROCHEBR., Polyplac. Cap Horn, p. 133.

A small but very distinct species, most of the specimens were considerably eroded showing that they had come to maturity. (*Gld.*)

The generic position of this form is problematical. It cannot be an *Acanthochites*. Rochebrune gives no information except that it was collected in the Strait of Magellan by the French expedition of 1882–83 to Cape Horn.

CHITON BRODERIPI Potiez & Michaud. It is oval, rotund, thick, of a brown or dirty white color; the dorsal line is smooth and blackish; the anterior valve is marked with a white spot at the summit, and the posterior is swollen and retuse within; these two valves and the intermediates valves are grooved, striated and somewhat granulated at the lateral areas from base to summit. The margin is thick and leathery. Length 40, width 30 mill. (P. & M., Galerie des Moll. du Mus. de Douai, i, p. 533, 1838).

Sea of Chili.

TONICIA GAUDICHAUDI Rochebrune. Shell ovate, subcarinated, shistaceous-tawny, pictured with small violaceous spots. Anterior valve and posterior part of posterior valve concentrically lineated;

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intermediate valves having the lateral areas extremely narrow-central areas very minutely reticulated all over. Marginal ligament very narrow, rufous. Length 10, breadth 6 mill. (*Rochebr.* in Bull. Soc. Philom. de Paris. 1883–1884, p. 35).

Chili (Gaudichaud) ; Mus. Paris.

11. *North Pacific species.*

CHÆTOPLEURA THOUARSIANA Rochebr. Shell ovate oblong, compressed, carinated ; subrufous, covered throughout with greenish spots. Anterior valve 10-rayed, granulose, the granules concentric, ally disposed, bordered with a broad margin. Posterior valve small, umbonated. Intermediate valves having the median areas longitudinally sulcated, the sulci angularly arranged. Lateral areas with impressed pits ["favis impressis"], laterally graniferous. Marginal ligament brown, with scattered rufous setæ. Length 32, breadth 14 mill. (*Rochebr.* in Bull. Soc. Philom. 1881–1882, p. 191).

Kamchatka (Du Petit-Thouars). Rare. Paris Mus.

This is, of course, a *Mopalia.*

CHITON SETOSUS Tilesius, Mem. Ac. St. Pétersb. (1st ser.) ix, p. 484, 1824. Not identified.

CHITON MURICATUS Tilesius, *l. c.*, p. 483, t. 16, f. 3. Not identified. See Middendorff, Mal. Ross., p. 129.

CHITON INCARNATUS Nuttall. Upper California. Jay's Catalogue, 3d. edit., p. 37. Name only.

CHITON INORNATUS Nuttall. Sandwich Is. *l. c.* Undescribed.

CHITON TEXTILIS Nuttall. Upper California. *l. c.* Undescribed.

12. *Species of unknown habitat.*

CHITON RUGULOSUS Sowerby. Median part of valves longitudinally rugulose ; lateral parts closely radiated. (*Sowb.*, Cat. Tank. Coll., p. v.). Habitat unknown.

CHITON VERSICOLOR Sowerby. Vol. XIV, pl. 27, figs. 45, 46.

Shell oblong, scarcely carinated, subattenuated in front. Central areas striated at the sides ; lateral areas radially striated, the striæ branching toward the edges. Margin most minutely scaly.

Length 1 inch, breadth ½ inch. (*Sowb.*)

The species is oval, oblong, rather narrower in front, the central areas nearly smooth in the middle, and striated at the sides ; lateral

areas covered with slight radiating ridges, which branch off toward the edges. The colors are sufficiently variable to justify the name given above; several varieties in the collection of Mr. Stainforth being variegated with rose, green and grey; and one communicated by Dr. Stanger, nearly white, with grey spots. (*Sowb.*)

Habitat unknown.

Chiton versicolor Sowb., Mag. of Nat. Hist., June, 1840, p. 292; Conch. Illustr., f. 75 and f. 122 (var.).

This seems to be an *Ischnochiton* of the *fruticosus* group, perhaps the same as *divergens* Rve.; but it has not been mentioned by later authors, and the present location of the type is unknown.

Chiton platymerus Sowerby. Pl. 10, fig. 7.

Shell ovate, scarcely keeled, slightly convex, smooth, of a dark chestnut color; marginal ligament coriaceous; anterior and posterior valves, and lateral areæ of the middle valves obtusely radiately ribbed; central areæ of the middle valves longitudinally striated; valves broad. (*Sowb.*).

Habitat unknown.

Chiton platymerus Sowb. in Zool. Capt. Beechey's Voyage, p. 149, t. 41, f. 11.

Chiton undulatus Sowerby. Pl. 10, fig. 20.

Shell oblong, rather convex, slightly keeled, marginal ligament coriaceous, undulated; valves smooth, of a dull, pale, greenish-brown, light brown in the center. The specimen appears to have been worn. It is probable that small bunches of hairs existed on the marginal ligament. (*Sowb.*, in Zool. Capt. Beechey's Voyage, p. 149, t. 41, f. 12).

The recognition of this species is impossible without an examination of the original specimen, which is probably lost. It is not the *Ch. undulatus* of Quoy and Gaimard. The habitat is unknown.

Chiton zonatus Blainville. Body elongated, subcarinated; girdle moderate, covered with small tubercles, mealy. Shell of 8 valves entirely perfectly smooth; the intermediates, the first larger and as if trilobed in front, and unguiculate at the summit; the others increasing from the front backward, with the lateral areas indicated by a carinated line. Color whitish gray, varied agreeably

with brown zones above, greenish beneath. (*Blainv.*, Dict. Sc. Nat. xxxvi, p. 545).

Habitat unknown.

This species is placed in the same section as the Acanthopleuras (*granulata, picea,* etc.) by Blainville.

CHITON RARIPILOSUS Blainville. Body oval, thick, convex, not carinated; girdle moderate, beset with large black flexible hairs, a little more numerous around the periphery. Shell of 8 thick valves, a little carinated; the two end valves a little smaller, the anterior semicircular, with 9 large teeth of insertion, the posterior transversely oval, with the insertion plate entire, winged anteriorly; intermediate valves alike, having a rounded projection in the middle of the anterior border; the plate of insertion somewhat winged, with a single deep slit on each side. Color brown on the girdle, the valves russet white outside and within. Length more than 3 inches. (*Blainv.*, Dict. Sc. Nat. xxxvi, p. 547).

Habitat unknown (coll. Blainv., from Dr. Leach).

Seems to be a Plaxiphora. Rochebrune has identified it with *Chiton setiger* King (Polyplac. Cap Horn, 1889).

CHITON MACULATUS Gmel., Syst. Nat. xiii, p. 3205.—Wood, Gen. Conch., p. 11. This is perhaps *C. tulipa* Quoy, but its identity is uncertain.

CHITON INDUS Gmel. Syst. Nat. xiii, p. 3205.—Wood, Gen. Conch. p. 15 (=*Chiton indicus* Chem., Conch. Cab. viii, p. 287, t. 96, f. 811). Add to doubtful synonyms of *C. squamosus* Linn.

CHITON BICOLOR Gmel., Syst. Nat. xiii, p. 3204.—Wood, Gen. Conch., p. 17. This is apparently a well characterized species, but I do not know of any to which it may be with confidence referred. The figures of Chemnitz (Conch. Cab. viii, p. 277, pl. 94, f. 794, 795) by which alone it is known, resemble such a shell as *Tonicia chilœnsis,* figured on pl. 42, fig. 40, of vol. XIV.

CHITON CERASINUS Chemnitz, Conch. Cab. viii, p. 278, t. 94, f. 796 and of GMELIN, Syst. Nat. xiii, p. 3204, is probably a synonym of *C. castaneus* Wood. The dried animal is said to be black. Habitat unknown.

CHITON THALASSINUS Gmel., Syst. Nat. xiii, p. 3206.—Wood, Gen. Conch. p. 24 (Schröter, Neue Litterat. iv, p. 4, t. 1, f. 1) is a wholly unidentifiable small 6-valved species, from the West Indies.

REFERENCE TO PLATES.

Plate 1.

FIGURE.		PAGE.
1.	Katharina tunicata Wood After Reeve,	41
2.	Katharina tunicata Wood; foot. Emerton del.,	41
3, 4.	Katharina tunicata Wood; head valve. Emerton del.,	41
5.	Katharina tunicata Wood; median valve. Pilsbry del.,	41
6, 7.	Katharina tunicata Wood; median valve. Emerton del.,	41
8–11.	Katharina tunicata Wood; tail valve. Emerton del.	41
12, 13.	Acanthochites formosus Rv. After Reeve,	33
14–22.	Acanthochites carpenteri Pils. Emerton del.,	35
23–26.	Acanthochites speciosus Ad. & Ang. E. A. Smith del.	32
27–35.	Acanthochites involutus Cpr. Emerton del.,	35

Plate 2.

36–44.	Acanthochites porrecta Cpr. (=*defilippii* T.-C.). Emerton del.,	19
45–48.	Acanthochites defilippii Tap.-Can. Viag. Magenta,	19
49.	Acanthochites hirudiniformis Sowb. (?) Emerton del.,	27
50.	Acanthochites rubrolineatus Lisch. Jap. Meeres-Conch.,	18
51, 52.	Acanthochites scutiger Rve. After Reeve,	20
53, 54.	Acanthochites circellatus Rve. After Reeve,	20
55.	Acanthochites asbestoides Cpr. Zool. "Alert,"	17
56.	Acanthochites hirudiniformis Sowb. Conch. Illustr.	27

Plate 3.

57, 58.	Acanthochites monticularis Q. & G. (=*porosus*). Voy. Astrol.,	36
59–62.	Acanthochites porosus Burr. Emerton del.,	36
63, 64.	Acanthochites floridanus Dall. Emerton del.,	37
65, 66.	Acanthochites bouvieri Roch. Nouv. Arch. Mus.,	13
67–71.	Acanthochites violaceus Q. & G. Emerton & Pilsbry del.,	39
72, 73.	Acanthochites porphyreticus Rv. (=*violaceus*). Conch. Icon.,	39
74.	Acanthochites costatus Ad. & Ang. Zool. "Alert,"	40

Plate 4.

77.	Acanthochites fascicularis L. After Forbes & Hanley,	9
78.	Acanthochites fascicularis, sculpture x 60. Pilsbry del.,	9

FIGURE. PAGE.

79. Acanthochites fascicularis L. side view of valve. Conch. Illustr., ... 9
80, 81. Acanthochites discrepans Brown. Conch. Illustr., . 12
82. Acanthochites discrepans, sculpture x 60. Pilsbry del., . 12
83. Acanthochites gracilis Jeffr. Ill. Ind. Brit. Sh., . . 11
84. Acanthochites penicillatus Dh. Pilsbry del., . . 15
85. Acanthochites exquisitus v. ampullaceus Pilsbry. Pilsbry del., ... 24
86, 97. Acanthochites bisulcatus Pils. Pilsbry del., . . 28

Plate 5.

1–11, Amicula pallasi Midd. Sib. Reis., ... 45
12. Amicula amiculata Cpr. Emerton del., ... 47
13, 14. Amicula amiculata Cpr. Emerton del., . . . 47
15, 16. Amicula amiculata Pallas. After Pallas, . . . 46

Plate 6.

1–5. Cryptochiton stelleri var. violaceus Nordm. After Nordmann, ... 50
6. Cryptochiton stelleri Midd. Four square mill. of surface magnified showing bunches of spicules. 48

Plate 7.

7. Cryptochiton stelleri Midd. Ross del., ... 48
8, 9. Cryptochiton stelleri. Two head valves. Emerton del. 48
10, 11. Cryptochiton stelleri. Two tail valves. Ross del., . 48
12. Cryptochiton stelleri. Seventh valve. Ross del., . . 48
13, Cryptochiton stelleri. Second valve. Mal. Ross., . . 48

Plate 8.

14. Cryptoplax striatus var. gunnii Rv. Conch. Icon., . 54
15. Choneplax latus Guild. Conch. Icon., ... 60
16–19. Choneplax hastatus Sowb. Ann. Mag., . . . 60
20, 21. Choneplax hastatus Sowb. Conch. Icon., . . . 60
22. Choneplax hastatus. Head, median and tail valve. Carpenter del., ... 60
23. Amicula emersonii (=vestita). Emerton del., . . 43
24, 26. Amicula vestita Sowb. Conch. Illustr., . . . 43
25. Amicula vestita Sowb. Conch. Icon., ... 43
27, 28. Acanthochites acutirostratus Rv. Conch. Icon., . 33
29, 30. Acanthochites penicillatus Dh. Moll. Réun., . . 15
31, 32. Acanthochites stygma Rochebr. Moll. Cap Horn, . 27
33, 34. Acanthochites adansoni Rochebr. Nouv. Arch., . 13

Plate 9.

FIGURE.	PAGE.
1. Cryptoplax oculatus Q. & G. Challenger Rep.,	55
2–5. Cryptoplax oculatus. Valves i, ii, iii and viii. Challenger Rep.,	55
6. Cryptoplax burrowi E. A. Smith. Conch. Icon.,	54
7–10. Cryptoplax burrowi. Valves i, ii, iii, and viii. E. A. Smith del.,	54
11–14. Cryptoplax striatus Lam. Challenger Rep.,	53
15. Cryptoplax striatus Lam. Challenger Rep.,	53

Plate 10.

1, 2 Chiton subassimilis Souv. Journ. de Conch.,	99
3, 4 Chiton discolor Souv. Journ. de Conch.,	89
5, 6. Chiton tuberculosus Souv. Journ. de Conch.	99
7. Chiton platymerus Sowb. Beechey's Voy.,	115
8, 9. Chiton obscurellus Souv. Journ. de Conch.,	99
10, 11. Tonicia insculpta Souv. Journ. de Conch.,	89
12. Chiton glaucocinctus Fremb. Zool. Journ.	109
13–17. Ischnochiton cessaci Roch. Nouv. Arch. Mus.,	81
18, 19. Chiton fimbriatus Sowb. Conch. Ill.,	110
20. Chiton undulatus Sowb. Beechey's Voy.,	115
21, 22. Chiton concinnus Sowb. Conch. Ill.,	79
23–26. Chætopleura pustulata Kr. Südafrik. Moll.,	73
27, 28. Callochiton sanguineus Dh. Moll. Réun.,	67
29, 30. Chætopleura jaspidea Gld. U. S. Expl. Exped.,	70

Plate 11.

31. Cryptoplax larvæformis Burrow. Ross del.,	56
32. Cryptoplax larvæformis. Edge of foot, showing marginal row of longer spicules. Pilsbry, del.,	56
33. Cryptoplax larvæformis, One sq. mill. of upper surface. Pilsbry del.,	56
34. Cryptoplax larvæformis. One of the sutural tufts. Pilsbry del.,	56
35. Cryptoplax larvæformis. Ross del.,	56
36. Cryptoplax larvæformis. Valves i, ii, iii, viii. Challenger Rep.,	56
37. Cryptoplax striatus Lam. Edge of foot, showing densely spiculose upper surface, and asperulate basal surface of girdle. Pilsbry del.,	53
38, 39. Cryptoplax striatus Lam. Ross del.,	53
40–43. Cryptoplax striatus. Valves i, ii, viii. Pilsbry del.,	53

Plate 12.

44, 45, 47. Acanthochites exquisitus Pils. Pilsbry del.,	23
46. Acanthochites exquisitus Pils. Ross del.,	23

FIGURE. PAGE.

48, 49, 51. Acanthochites rhodeus Pils. Pilsbry del., . . 26
50. Acanthochites rhodeus Pils. Ross del., ... 26
52. Acanthochites diegoensis Pils. Ross del., . . . 25
53, 54. Acanthochites diegoensis Pils. Pilsbry del., . . 25

PLATE 13.

55, 56. Acanthochites astriger Rve. Pilsbry del., . . . 22
57. Acanthochites astriger Rve. Conch. Icon., . . . 22
58, 59. Acanthochites pygmæus Pils. Pilsbry del., . . 23
60, 61. Acanthochites spiculosus Rve. Conch. Icon., . . 22
62. Acanthochites spiculosus Rv. Emerton del., . . 22
63, 64. Callochiton inornatus Ten.-Woods. Tr. Roy. Soc. Vict., 68
65. Acanthochites hemphilli Pils. Pilsbry del., . . . 34
66. Acanthochites hemphilli Pils. Ross del., . . . 34
67. Acanthochites hemphilli. Posterior view of tail valve. Pilsbry del., ... 34

PLATE 14.

1, 2. Chætopleura asperrima Couth. U. S. Expl. Exped., . 70
3, 4. Tonicia floccata Sowb. Conch. Icon., ... 90
5. "Chiton" castaneus Couth. U. S. Expl. Exped., . . 113
6, 7. Plaxiphora? hyadesi Roch. Moll. Cap Horn, . . 112
8. Ischnochiton cariosus Cpr. Ross del., . . . 82
9, 10. Acanthochites zelandicus Q. & G. Voy. Astrol., . 16
11–16. Acanthochites garnoti Blv. Voy. Astrol., . . 14
17. Ischnochiton haddoni. Girdle-scale, . Vol. xiv, 88
18. Ischnochiton longicymba var. Girdle-scales. Vol. xiv, 87
19. Ischnochiton longicymba var. Ross del., " " 87
20, 21. Lepidopleurus algesirensis Cap. Journ. de Conch., . 62

PLATE 15.

22–24. Tonicella saccharina Dall. Pilsbry del., . . . 66
25. Trachydermon ruber, girdle-scales. Pilsbry del., . . 65
26. Trachydermon dentiens. Girdle-scales. Pilsbry del., . 65
27. Ischnochiton smaragdinus Ang. P. Z. S., . Vol. xiv, 137
28, 29. Ischnochiton gothicus Cpr. Pilsbry del., . . 65
30–33. Callochiton aleuticus Dall. Pilsbry del., . . 65
34, 36. Trachydermon flectens Cpr. Pilsbry del., . . 64
35. Trachydermon flectens Cpr. Ross del., . . . 64
37. Trachydermon flectens. Girdle-scales. Pilsbry del., . 64
38–41. Chætopleura asperior Cpr. Pilsbry del., . . . 74

PLATE 16.

42–46. Ischnochiton serratus Cpr. Pilsbry del.. . . . 78
47, 50, 51, 52. Ischnochiton reteporosus Cpr. Pilsbry del., . 77

FIGURE. PAGE.
53. Ischnochiton reteporosus Cpr. Sheppard del., . . . 77
48, 49. Ischnochiton radians Cpr. Pilsbry del. . . . 75
54. Callistochiton decoratus var. Sheppard del., . . 87
55, 56. Ischnochiton scabricostatus Cpr. Pilsbry del., . 76

Plate 17.

57–59. Ischnochiton cultratus Cpr. Pilsbry del., . . 82
60, 61. Ischnochiton bisculptus Cpr. Pilsbry del., . . 83
62, 63. Ischnochiton craticulatus Gld. Pilsbry del., . . 84
64–66. Ischnochiton trifidus Cpr. Pilsbry del., . . . 86
67. Ischnochiton trifidus Cpr. Sheppard del., . . . 86
68. Ischnochiton lugubris Gld., (=australis Sowb.). Pilsbry del., ... 87
69. Ischnochiton lugubris Gld., (=australis Sowb.). Sheppard del., ... 87

INDEX TO POLYPLACOPHORA.

NOTE.—The names of genera and other groups are printed in SMALL CAPITALS; of species known or supposed to be valid in Roman type; the names of all synonyms in *Italic*.

Abyssorum Sars. xiv, . 18
Acanthochætes Auct. xv, . 8
Acanthochistes Costa, xv, . 8
ACANTHOCHITES Risso, xv, 7, 8
ACANTHOCHITIDÆ Pils. xv, 6
Acanthochitona Gray, xiv, . 150
Acanthochiton Herrm. xv, . 8
ACANTHOPLEURA Guild. xiv, . . . 213
Achates Gld. xv, . . 18
Achatinus Brown, xiv, . 49
Acrior Cpr. xiv. . . 61
Aculeatus L. xiv, . . 221
Aculeatus Rve. xiv, . . 219
Acutiliratus Rv. xiv, . . 65
Acutirostratus Rv. xv, . 33
Acutus Cpr. xiv, . . 297
Adamsii Cpr. xiv, . . 111
Adansoni Roch. xv, . . 13
Adelaidensis Rv. xiv, . 136
Adenensis Smith. xiv, . 276
Adriella Thiele, xv, . 62, 63
Æneus Risso. xv, . . 10
Æreus Rv. xiv, . . 179
Affinis Issel xiv, . . 181
Afra Roch. xv, . . 96
Africana Roch. xiv, . . 181
Ahnni Roch. xv, . . 112
Alatus Sowb. xiv, . . 60
Albidus Blv. xv, . . 105
Albilineatus Rv. xiv, . . 160
Albolineatus Sowb. xiv, . 160
Albrechti Schr. xiv, . 147
Albus Barb. xiv, . . 256
Albus L. xiv, 70; xv, . 64
Albus Pult. xiv, . . 4
Aleutica Dall, xv, . . 65
Algesirensis Cap. xv, . . 62
Alphonsinæ Roch. xv, . 100
Alternatus Sowb. xiv, . 281
Altior Cpr. xv, . . 45
Altus Gray, xiv, . . 60
Alveolatum Roch. xv, . 96
Alveolus Sars xiv, . . 6, 4
Amaurochiton Th. xv, . 88
Ametrogephyrus Midd. xv, . 52
Amicorum Baird. xiv, . 249
AMICULA Gray, xv, . . 42
Amiculatus Pall. xv, . . 46
Amiculatus Rv. xv, . . 44
Amiculatus Sowb. xv, . 49
AMPHITOMURA Pils. xiv, . 230
Ampullaceus Pils. xv, . 24
Anaglyptus Roch. xv, . 97
Angasi Ad. & Ang. xiv, . 238
ANGASIA Cpr. xiv, . . 286
Angulatus Spengl. xv, . 72
Angusticostatus Q. & G. xiv, . . . 187
Anisochiton Fisch. xiv, . xxi
Anthochiton Th. xv, . . 88
Antiquus Rve. xiv, . . 274
Apicalis Pils. xv, . . 50
Apiculata Say, xiv, . . 35
Apparata Cpr. xiv, . . 38
Aquatilis Rv. xiv, . . 169
Arbutum Rv. xiv, . . 139
Arcticus Sars, xiv, . . 5
Arenatus Nutt. xiv, . . 295
Argyrosticta Phil. xiv, . 204

Armatus Nutt. xiv, . . 295
Armatus Pse. xv, . . 21
Armillata Cpr. xiv, . . 39
Arragonites Cpr. xv, . . 25
ARTHURIA Cpr. xiv, . . 258
Articulatus Sowb. xiv, . 159
Asbestoides Cpr. xv, . 17
Aselloides Lowe, xiv, . . 71
Asellus Midd. xiv, . . 4
Asellus Speng. xiv, . . 13
Asmus xv, . . . 49
Asperrimus Couth. xv, . 70
Asperior Cpr. xiv, 77; xv, 74
Asper Shutt. xiv, . . 38
Assimilis Rve. xiv, . . 155
Astriger Rv. xv, . . 22
Astrolabei Roch. xv, . . 107
Ater Pils. xiv, . . 155
Atlantica V. & S. xiv, . 313
Atrata Sowb. xiv, . . 201
Attenuata Jeffr. xv, . . 10
Aurantius Cpr. xiv, . . 176
Aureotinctus Cpr. xiv, . 123
Aulacochiton Shutt. xiv, . 236
Australis Sowb. xiv, 144; xv, ... 87
Avicula Cpr. xv, . . 24

Balansæ Roch. xiv, . . 222
Barnesii Gray, xiv, . . 190
Beanella Dall, xiv, . . 282
Beanella Thiele, xv, . . 75
Beania Cpr. xiv, . . 282
Beanii Cpr. xiv, . . 32
Belknapi Dall, xiv, . . 7
Bellignyi Roch. xv, . . 29
Benthus Dall, xiv, . . 9
Bergoti Vel. xv, . . 80
Biarmata Roch. xv, . . 103
Bicostatus d'Orb. xiv, 271, 272
Bicolor (Ad.) Gray, xiv, . 291
Bicolor Gm. xv, . . 116
Bicolor Spengl. xv, . . 68
Bipunctata Sowb. xiv, . 46
Biradiatus Sowb. xv, . 98
Biramosa Q. & G. xiv, . 319
Bisculptus Cpr. xv, . . 83
Bistriatus Wood, xiv, . 154
Bisulcatus Pils. xv, . . 28
Blainvillei Cpr. xiv, . . 311
Blainvillii Brod. xiv, . 310
Blauneri Shutt. xiv, . 228, 229
Bœtica Cpr. xiv, . . 201
Bœticus Cpr. xv, . . 21
Boogii Had. xiv, . . 113
Borbonicus Dh. xiv, . . 230
Borealis Pils. xiv, . . 309
BOREOCHITON Sars. xv, . 63
Bottæ Roch. xv, . . 98
Bouvieri Roch. xv, . . 13
Bowenii King, xiv, . . 164
Brandti Midd. xiv, . . 47
Brevispinosus Sowb. xiv, . 231
Broderipi P. & M. xv, . 113
Bruguieri Pot. & Mich. xiv, 198
Bullata Cpr. xiv, . . 31
Burmanus Cpr. xiv, . . 171
Burrowi E. A. Sm. xv, . 54

Cælatus Rv. xiv, . . 328
Cærulescens Shuttlew. xiv, . 192
Cajetanus Poli. xiv, . . 15
Calcifera Cpr. xiv, . . 32
Calculosa Cpr. xiv, . . 288
Caledonicus Roch. xv, . 58
Californicus Nutt. xiv, . 279
Californicus Presc. xv, . 49
Caliginosus Cpr. xiv, . 244
Caliginosus Rv. xv, . 98
CALLISTOCHITON, xiv, . 260
CALLISTOPLACINÆ, xiv, . 259
CALLISTOPLAX Cpr. xiv, . 288
CALLOCHITON Gray, xiv, 48; xv, ... 67
Campbelli Filh. xv, . . 107
Canaliculatus Q. & G. xiv, 177
Canariensis Orb. xiv, . . 184
Cancellatus Sow. xiv, . 3
Candisatus Chemn. xv, . 72
Candisatus Shutt. xiv, . 37
Capensis Gray, xiv, . . 188
Caprearum Scac. xiv, . 283
Caribæorum Cpr. xiv, . 107
Carinatus Ad. & Ang. xv, . 17
Carinatus Risso xv, . . 10
Carinulatus Rve. xiv, . 96

Cariosus Cpr. xiv, 66, xv, . 82
Carmichaelis Gray, xiv, . 317
Carnosus Cpr. xiv, . . 176
Carpenteri Ang. xiv, . . 208
Carpenteri Had. xiv, . 325
Carpenteri Pils. xv, . . 35
Castaneus Couth. xv, . 113
Castaneus Wood, xiv, 52, xv, ... 68
Castaneus Q. & G. xv, . 72
Castus Cpr. xiv, . 93, 94
Castus Rv. xiv, . 93, 94
Catenulatus Sowb. xiv, . 110
Catillus Rv. xiv, . . 10
Cayetanus Risso xiv, . . 15
Cerasinus (Chemn.) Rv. xiv, 53
Cerasinus Gm. xv, . . 116
Ceratophorus Cpr. xiv, . 290
CERATOZONA Dall, xiv, . 290
Cessaci Roch. xv, . . 81
CHÆTOPLEURA Shutt. xv, . 69
Chemnitzii Pfr. xiv, . 156
Chilensis Fremb. xiv, . 197
Chiloensis Sowb. xiv, . . 199
CHITON L. xiv, . . 148, 149
Chitonellus Blv. xv, . . 57
Chitonellus Lam. xv, . . 52
CHITONINÆ xiv, . . 148
Chitoniscus Cpr. xv, . . 59
Chlamydochiton Dall, xv, . 48
Chlamys Rv. xv, . . 49
Chondroplax Th. xv, . . 88
CHNOEPLAX Cpr. xv, . 51, 59
Ciliata Ang. xiv, . . 326
Ciliatus Reeve xiv, . . 295
Ciliatus Sowb. xiv, . . 303
Cimex Chem. xiv, . . 69
Cimicinus Landt. xiv, . 69
Cimolius Rv. xiv, . . 238
Cinereus Fab. xiv, . . 81
Cinereus L. xiv, . . 68
Cinereus Mont. *et al.* xiv, . 13
Cinereus Poli. xiv, . . 283
Cinereus Sars, xiv, . . 14
Cingillatus Rv. xv, . . 110
Circellatus Ads. & Rv. xv, 20
Circumvallatus Rv. xiv, . 69
Clathratus Cpr. xiv, . . 124
Clathratus Reeve, xiv, . 128
Clathropleura Tib. xv, 67, 88
Clypeus Blv. xv, . . 104
Coarctatus Sowb. xiv, . 25
Coccus Mke. xv, . . 102
Collei Rv. xiv, . . 295
Colubrifer Rve. xiv, . . 95
Columbiensis Sowb. xiv, . 34
Communis Risso. xv, . 13
Complexa Hutt. xv, . . 108
Comptus Gld. xiv, . . 117
Concentricus Rv. xiv, . . 178
Concharum Roch. xv, . 98
Concinnus Gld. xiv, . 11, 5
Concinnus Sowb. xv, . 79
Confossa Gld. xiv, . . 210
Consimilis Nutt. xiv, . . 295
Conspersa Ang. xiv, . . 324
Conspicua Cpr. xiv, . . 63
Conspicuus Cpr. xiv, . . 63
Constanti Vel. xv, . . 80
Contractus Rv. xiv, . . 93
Convexus Blainv. xiv, . 228
Cooperi Cpr. xiv, . . 127
Coppingeri Smith, xiv, . 275
Coquimbensis Fremb. xiv, . 253
Corallinus Risso. xiv, . 181
Coreanicus Ad. & Rv. xiv, 129
Corephium Gray, xiv, . 218
Corrosus Roch. xv, . . 108
Corrugatus Cpr. xiv, . . 124
Corrugatus Rv. xiv, . . 284
Corticata Hutt. xiv, . . 320
Costatus Ad. & Ang. xv, . 40
Costatus Blv. xv, . . 105
Costatus C. B. Ad. xiv, . 157
Couthouyi Roch. xv, . 113
Cranchianus Leach, xiv, . 49
Craspedochilus Sars. xiv, . 67
Craspedochilus Sars. xv, . 62
CRASPEDOCHITON Shutt. xiv, ... 285
Crassicostatus Pils. . . 264
Craticulatus Gld. xv. . 84
Crenulata Sowb. xiv, . 195
Crenulatus Loc. xiv, . 284
Crinitus Penn. xv, . 10
Crispus Rv. xiv, . . 89

Crocinus Rv. xv, . . 67
Cryptochiton Midd. xv, 48
Cryptoconchus Blv. & Guild, xv, . . . 35
Cryptoplacidæ xv, . 51
Cryptoplax Blv. xv, 51, 52
Cullierети Roch. xv, . 111
Cultratus Cpr. xv, . . 82
Cumingi Fremb. xiv, . . 164
Cumingsii Fremb. xiv, . 165
Cunninghami Rve. xiv, . 225
Cupreus Cpr. xiv, . . 328
Curtisianus Smith, xiv, . 242
Curvata Cpr. xiv, . . 17
Curvatus Cpr. xiv, . . 16
Cyaneopunctatus Kr., xiv, 135; xv, . . . 82
Cyanoplax Pils. xiv, 40, 44; xv, . . . 63
Cymbiola Sowb. xiv, . . 186
Cymbium xv, . . . 88

Dacrydigera Roch. xv, . 111
Dakariensis Roch. xv, . 29
Dallii Had. xiv, . . 133
Daniellii Sowb. xv, . . 15
Dawsonia Cpr. xiv, . . 282
Debilis Gray, xiv, . . 18
Defilippii Tap.-Can. xv, . 19
Defilippii Tap.-Can. xiv, . 243
Decipiens Cpr. xiv, . . 123
Decipiens Roch. xv, . . 106
Decipiens Tib. xiv, . . 284
Decoratus Cpr. xiv, 269; xv, 87
Decussatus Rv. xiv, . 93, 94
Densiliratus Cpr. xiv, . 169
Dentatus Spengl. xiv, 84; xv, ... 68
Denticularis Chem. xiv, . 157
Dentiens Gld. xiv, 73; xv, 65
Depressus Blv. xv, . . 37
Deshayesiella Cpr. xiv, 1, 16
Diarthrochiton Fisch. xiv, xxi
Dichachiton Midd. xiv, xvii
Dieffenbachii Rv. xiv, . 35
Diegoensis Pils. xv, . 25
Dimorphus Roch. xv, . 111
Dinoplax, Cpr. xiv, . 254
Diochiton Th. xv, . . 88
Discolor Souv. xiv, . . 175
Discors Mat. & Rack. xiv, . 49
Discrepans Brown, xv, . 12
Disjunctus Fremb. xiv, . 212
Dispar Ad. xiv, . . 112
Dispar Sowb. xiv, . . 111
Dissimilis Rv. xiv, . . 184
Divergens Reeve, xiv, . 90
Doriæ Capell. xiv, . . 49
Dorsuosus Had. xiv, . . 135
Douglasiæ Gray, xv, . 42

Echinatum Bar. xiv, . . 218
Echinotus Blv. xv, . . 30
Ectypus Roch. xv, . . 89
Egregia H. Ad. xiv, . 331
Elegans Blv. xv, . . 104
Elegans Fremb. xiv, . . 196
Elenensis Sow. xiv, . . 267
Elevata Pils. xiv, . . 300
Ellinensis Sow. xiv, . . 268
Elongatus Blv. xv, . . 105
Elongatus Rve. xiv, . . 236
Emersonii Couth. xv, . . 44
Empleurus Hutt. xv, . . 67
Enoplochiton Gray, xiv, . [234, 252
Eochiton Fisch. xiv, xxi
Eruciformis Sowb. xv, . 57
Erythronotus Ad. xiv, . 104
Eschscholtzii Midd. xiv, . 300
Estuarii Chier. xiv, . . 181
Eudoxochiton Shuttlw. xiv, . . . 149, 192
Euplœæ Costa, xv, . . 67
Euplaxiphora Shutt. xiv, [311, 315
Evanidus Sowb. xiv, . . 145
Exaratus Sars. xiv, . . 71
Excavatus Gray, xiv, . . 157
Exquisitus Pils. xv, . . 23
Exiguus Sowb. xiv, . . 98
Excurvata Cpr. xiv, . . 327
Expressus Cpr. xiv, . . 268

Fallax Cpr. xiv, . . 59

FANNETTIA Dall, xiv, 195, 212
Fannia Cpr. xiv, . . 212
Fannyia Gray, xiv, . . 212
Fasciatus Q. & G. xv, . 57
Fasciatus Rv. xv, . . 55
Fasciatus Wood, xiv, . . 156
Fascicularis L. xv, . . 9
Fastigiata Gray, xiv, . 199
Ferrugineus Spengl. xv, . 72
Festivus Blv. xv, . . 69
Flavescens Cpr. xiv, . 33
Flectens Cpr. xv, . . 64
Flemmingius Leach, xiv, . 41
Floccatus Sowb. xv, . . 90
Floridanus Dall, xv, . . 37
Floridanus Pils. xiv, . . 58
Fluxa Cpr. xiv, . . 281
Fodiatus Roch. xv, . . 103
Fontainei Roch. xiv, . . 204
Forbesii Cpr. xiv, . . 196
Formosus Rv. xv, . . 33
Fortiliratus Rv. xiv, . . 207
Foveolatus Sowb. xiv, . 157
Fragilis Monts. xiv, . . 103
Francisia Cpr. xiv, . . 219
Freelandi Fbs. xiv, . . 182
Frembleii Brod. xiv, . . 318
Frembleya H. Ad. xiv, . 330
FREMBLYA H. Ad. xiv, 312, 330
Fremblyi Brod. xiv, . . 318
Frigida Roch. xiv, . . 317
Fruticosus Gld. xiv, . . 91
Filholi Roch. xv, . . 106
Filosus Cpr. xiv, . . 258
Fimbriatus Cpr. xiv, . . 265
Fimbriatus Sowb. xv, . 110
Fissa Cpr. xiv, . 298, 299
Fulgetrum Rv. xv, . . 68
Fuliginatus Ad. & Rv. xiv, 10, 4
Fulminatus Couth. xiv, . 41
Fulvus Wood, xv, . . 71
Funiculatus Cpr. xiv, . 108
Furtivus Monts. xv, . 95
Fuscatus Brown, xiv, . 69
Fuscatus Leach, xiv, . . 14
Fuscus Gmel. xv, . . 73

Gabbi Pils. xiv, . . 270
Gaditanus Chemn. xv, . 72
Gaimardi Blv. xiv, . . 240
Gambiensis Roch. xv, . 95
Garnoti Blv. xv, . . 14
Gaudichaudi Roch. xv, . 113
Gemmatus Blainv. xiv, . 222
Gemmea Cpr. xiv, . . 31
Gemmulatus Shuttlw. xiv, . 157
Georgianus Q. & G. xiv, . 241
Georgus Th. xv, . . 88
Giganteus Tiles. xv, . . 49
Gigas Gmel. xiv, . . 255
Glaucocinctus Fremb. xv, . 109
Glaucus Gray, xiv, . . 172
Glaucus Q. & G. xiv, . 325
Globulosus Chier. xv, . 10
Goodallii Brod. xiv, . 191
Gothicus Cpr. xv, . . 65
Gracilis Jeffr. xv, . . 11
Granatus Rv. xiv, . 224, 225
Graniferus Sowb. xiv, . 200
Granofilosus Cpr. xiv, . 148
Granoliratus Cpr. xiv, 14; xv, ... 62
Granosus Fremb. xiv, . 167
Granulatus Gmel. xiv, . 227
Granulosus Fremb. xv, . 110
Grayi Ad. & Ang. xiv, . 21
Grayi Cpr. xiv, . . . 304
Grayi Sowb. xiv, . . 200
Gryei Filh. xv, . . 107
GUILDINGIA Cpr. xiv, 312, 329
Guildingi Rv. xiv, . . 291
Gunnii Rv. xv, . . 54
Gymnoplacidæ Gray, xiv, . 150
Gymnoplax Gray, xiv, . 150

Haddoni Pils. xiv, . . 88
Hakodadensis Cpr. xiv, . 147
Hahni Roch. xiv, . 318, 319
Hamachiton Midd. xiv, xvii
Hamatus Roch. xv, . . 11
Hamyi Roch. . . . 183
Hanleia Cpr. xiv, . . 17
HANLEYA Gray xiv . . 17
Hanleyia Dall, xiv . . 17
Hanleyi Bean, xiv, . . 17
Hartwegii Cpr. xiv, . . 45

Hastatus Sowb. xv, . . 60
Helioradsia Th. xv, . . 70
HEMIARTHRUM Cpr., xiv, 1, 19
Hemphillia Cpr. xiv, . . 256
Hemphilli Pils. xv, . . 34
Hennahi Gray, xiv, . . 29
Heterodon Pils. xiv, . 276
HETEROZONA Cpr. xiv, . 65
Heurteli Roch. xv, . . 59
Hindsii (Sowb.) Rv. xiv, . 296
Hirtosus Péron. xv, . . 106
Hirudiniformis Sowb. xv, . 27
Holochiton Fisch. xiv, . xxi
Hookeri Gray, xv, . . 16
Horniana Roch. xiv, . . 203
Huttoni Pils. xiv, . . 194
Hyadesi Roch. xv, . . 112

Icoplax Thiele, xv, . 62, 63
Illuminatus Rv. xiv, . . 51
Imitator Smith, xiv, . . 116
Imporcata Cpr. xiv, . . 302
Inca d'Orb. xv, . . . 79
Incana Haddon, xiv, . . 243
Incanus Gld. xiv, . . 241
Incarnatus Nutt. xv, . . 114
Incarnatus Rv. xiv, . . 81
Incii Rv. xiv, . . . 248
Incisus Sowb. xiv, . . 235
Indus Gm. xv, . . 116
Infortunatus Pils. xiv, . 266
Infuscatus Schn. xv, . . 64
Inornatus Nutt. xv, . . 114
Inornatus T.-W. xv, . . 68
Inquinatus Rv. xiv, . . 90
Insculpta Souv. xv, . . 89
Insculptus Ad. xiv, . . 177
Insignis Newc. xiv, . . 300
Insignis Rve. xiv, . . 42
Insularis Roch. . . 183
Intergranosus Cpr. xiv, . 93
Internexus Cpr. xiv, . 12, 5
Interruptus Cpr. xiv, . 166
Interstinctus Gld. xiv, . 119
Intricandus Cpr. xiv. . 91
Intricatus Cpr. xiv, . 91
Isabellei Orb. xiv, . . 35
ISCHNOCHITON Gray, xiv, 53, 86
ISCHNOCHITONIDÆ, xiv, . 253
ISCHNOCHITONINÆ, xiv, . 254
ISCHNOPLAX Cpr. xiv, . 64
Ischnoradsia Cpr. xiv, . 139
ISCHNORADSIA Shuttlew . xiv, ... 144
Islandicus Gmel. xiv, . 14
Involutus Cpr. xv, . . 35

Jacobæus Gld. xiv, . . 267
Jamaicensis Cpr. xiv, . . 108
Janeirensis Gray, xiv, . 37
Janeirensis Rve. xiv, . 39
Japonicus Lisch. xiv, . . 242
Jaspideus Gld. xv, . . 70
Joallesi Roch. xv, . . 30
Jucundus Roch. xv, . . 29
Jugosus Gld. xiv, . . 178
Juloides Ad. & Ang. xiv, . 55

Kalison Adans. xv, . 13
KATHARINA Gray, xv, . 41
Kennerleyi Cpr. xiv, . 304
Kerguelensis Had. xiv, . 12

Labeculatus Rv. xiv, . 36
Lævigatus Flem. xiv, . . 41
Lævigatus Sowb. xiv, . 159
Lævis Lam. xv, . . 56
Lævis Mont. xiv, 49; xv, . 67
Lævis Penn. xiv, . . 81
Lævis Rv. xv, . . 57, 60
Lamellosus Q. & G. xv, . 209
Lanuginosus Cpr. xiv, . 257
Laqueatus Sowb. xiv, . 285
Larvæformis Blv. xv, . 56
Larvæformis Rv. xv, . 55
Lateritius Shutt. xiv, . 105
Latus Guild. xv, . . 60
Latus Leach, xiv, . . 81
Latus Lowe xiv, . . 41
Latus Sowb. xiv, . . 161
Leachi Blv. xv, . . . 37
Lebruni Roch. xiv, . . 203
Lentiginosus Sowb. xiv, . 135
Lentiginosus Sowb. xv, . 82
LEPIDOPLEURIDÆ, xiv, . 1
Lepidopleurus Cpr. xiv, 125, 86

Lepidopleurus H. & A. Ad. xiv, ... 86
LEPIDOPLEURUS Risso. xiv, 1, 2
Lepidoradsia Cpr. xiv, . 144
LEPIDOZONA Pils. xv, . 82
Lepidus Gld. xiv, . . 117
Leptochitona Gray, xiv, . 150
Leptochiton Gray, xiv, . 2
LEPTOPLAX Cpr. xv, 7; xiv, 25
Lignosus Gld. xiv, . . 299
Limaciformis Sowb. xiv, . 57
Limans Cpr. xiv, . . 176
Lindholmi Schr. xiv, . 85
Lineata Wood, xiv, . 42
Lineolata Hutt. xv, . . 89
Lineolatus Blv. xv, . . . 105
Lineolatus Frem. xiv, . 198
Linter Rv. xv, . . 73
LIOLOPHURA Pils. xiv, 234, 239
LIOLOPHURINÆ Pils. xiv, . 232
Liratus Ad. & Ang. xv, . 101
Literatus Kr. xiv, . . 251
Lividus Midd. xiv, . . 76
Lobatus Cpr. xv, . . 69
LOBOPLAX Pils. xv, . . 38
Longicymba Auct. xiv, . 88
Longicymba Quoy, xiv, . 87
Loochooanus B. & S. xiv, . 244
Lophyriscus Thiele, xv, . 75
Lophyrus Poli. xiv, . 149
Lophyrus Sars. xv, . . 62
LORICA Ads. xiv, . 233, 236
LORICELLA Pils. xiv, 234, 238
Lucia Gld. xiv, . . 210
Lucilina Dall, xv, . . 89
Ludoviciæ Roch. xv, . . 100
Ludwigi Kr. xiv, . . 99
Lugubris Gld. xv, . . 87
Lurida Sowb. xiv, . . 33
Luridus Sowb. xiv, . . 33
Lusitanicus Tiles. xv, . 72
Lutulatus Shutt. xiv, . . 107
Luzonicus Sowb. xv, . 85
Lyellii Sowb. xiv, . . 247
Lyratus Sowb. xiv . . 184

Macandrei Cpr. xiv, . . 132
Macandrellus Cpr. xv, . 31
Macgillivrayi Ad. xiv, . 224
Macgillivrayi Cpr. xiv, . 101
Maculatus Gm. xv, . . 116
Magdalenensis Hds. xiv, . 62
Magdalensis xiv, . . 62
Magellanicus Gmel. xiv, . 227
Magnificus Dh. xiv, . . 160
Magnificus Gray, xiv, . 225
Maillardi Dh. xiv, . . 250
Margaritiferum Roch. xv, . 109
Marginatus auct. xiv, . 49
Marginatus Monts. *et al.* xiv, 70
Marginatus Penn. xiv, . 69
Marquesanus Pils. xiv, . 170
Marmoratus Gmel. xiv, . 158
Marmorea Fab. xiv, . 41
Marmoreus Chem. xiv, . 158
Marmoreus Fabr. xiv, . 41
Marmoreus Rv. xiv, . 156
Martieli Roch. xiv, . . 203
Maugerella Cpr. xiv, . 61
MAUGERIA Gray, xiv, . 226
Mauritianus Q. & G. xiv, . 188
Maximus Ch. xiv. . . 255
Mecynoplax Th. xv, . . 92
Mediterraneus (Gray) Rv. xiv, ... 103
Melanotrephus Roch. xv, . 97
Melanterus Roch. xv, . 107
Melphictensis Poli. xiv, . 283
Mendicaria Migh. xiv, . 18
Mendicarius Migh. xiv, . 18
Meneghinii Cap. xiv, . . 103
Merckii Esch. xiv, . . 300
Mertensii Midd. xiv, . . 125
Mesoglyptus Pils. xiv, . 164
MESOTOMURA Pils. xiv, . 218
Metallicus Rv. xiv, . . 145
MICROPLAX Ad. xiv, 2, 21
MIDDENDORFFIA Cpr. xiv, [278, 282
Middendorffii Schr. xiv, . 301
Milleri Gray, xiv, . . 137
Miles Cpr. xiv, . . . 189
Miniaceus Cpr. xiv, . . 175
Minimus Chem. xiv, . . 13
Minimus Gmel. xiv, . . 71
Minimus Monts. xv, . . 95

Minimus Spengl. xiv, . 81
Mirabilis Pils. xiv . . 263
Modesta Cpr. xiv, . . 324
Molpalia Gray, xiv, . . 294
Montanoi Roch. xv, . . 58
Montereyensis Cpr. xiv, . 300
Monticularis Q. & G., xv, . 37
Montrouzieri Souv. xv, . 90
MOPALIA Gray, xiv, . . 294
MOPALIIDÆ xiv, . . 293
MOPALIOPSIS Th. xv, . 110
Mucronulatus Shutt. xiv, . 229
Multicostatus C. B. Ad. xiv, 65
Multicostatus Dall, xiv, . 57
Multidentatus Cpr. xiv, 85; xv, ... 65
Multimaculatus Blv. xv, . 104
Muricatus Ad. xiv, . . 175
Muricatus Tiles. xv, . . 114
Murrayi Had. xiv, 161; xv, 88
Muscarius Rv. xiv, . . 132
Muscosus Gld. xiv, . . 295

Nagelfar Lov. xiv, . . 18
Nebulosus Cpr. xiv, . . 134
Nebulosus Wood. xiv, . 230
Neglectus Roch. xv, . . 106
Newcombia Cpr. xiv, . . 290
Newcombi Cpr. xiv, . . 120
Nexus Cpr. xiv, . . 11,5
Nicobaricus Chem. xiv, . 221
Niger Bar. xiv, . . 252
Nigropunctata Cpr. xiv, . 207
Nigrovirens Blainv. xiv, . 187
Nobilis Gray, xiv, . . 193
Nobilis (Rv.) Cpr. xiv, . 30
Noemiæ Roch. xv, . . 100
NOTOPLAX Ad. xv, . . 31
Novæhollandiæ Gray, xiv, 145
Nuttallii Cpr. xiv, . . 46
NUTTALLINA Cpr. xiv, . 277
Nympha Roch. xv, . . 103

Obesus Shutt. xiv, . . 226
Obscurellus Souv. xv, . 99
Obtecta Cpr. xiv, . . 330
Obtusus Cpr. xiv, . . 134
Occidentalis Rve. xiv, . 228
Oculatus Q. & G. xv, . 55
Oculatus Rv. xv, . . 53
Olivaceus Fremb. xiv, . 161
Olivaceus Speng. xiv, . 180
Oniscus Kr. xiv, . : 100
ONITHOCHITON Gray, xiv, [234, 244
Onyx Speng. xiv, . . 14
Onythochiton Gray, xiv, . 244
Ornatus Nutt. xiv, . . 295
Ornithochiton Cpr. xiv, . 244
Oryza Spengl. xiv, . . 71
Osteochiton Dall, xiv, . 294
Ovata Hutt. xiv, . . 332
Owenii Gray, xiv, . . 222

Pachylasmæ Seg. xv, . 95
Pagenstecheri Pfeffr. xiv, . 12
Pallasii Midd. xv, . . 45
Pallidulus Rve. xiv, . . 95
Pallidus Rv. xiv, . . 89
PALLOCHITON Dall, xiv, . 256
Palmulatus Cpr. xiv,. . 262
Papilio Spengl. xv, . . 72
Papillosus Ad. xiv, . . 114
Parallelus Cpr. xiv, . . 34
Patulus Sowb. xiv, . . 166
Pectinatus Cpr. xiv, . . 129
Pectinatus Sowb. xiv, . 64
Pectinulatus Cpr. xiv, . 129
Pellisserpentis Q. & G. xiv, 173
Penicillatus Dh. xv, . 15
Pergranatus Dall, xiv, . 6
Peroni Roch. xv, . . 58
Perornatus Cpr. xiv, . . 77
Pertusus Rve. xiv, . . 103
Peruviana Lam. xiv, . 28
Peruvianus Lam. xiv, . 29
Perviridis Cpr. xiv, . . 170
Petaloides Gld. xiv, . . 118
Petasus Rv. xiv, . . 311
Petholatus Sowb. xiv, . 323
Phacellopleura Cp. xv, . 38
Phakellopleura Guild. xv, . 8
Phœnochiton Midd. xiv, . xvii
Phaseolinus Monts. xv, . 94
Philippii Issel. xiv, . . 182
Piceolus Shutt. xv, . . 88

Piceus Angas, xv, . . 91
Piceus Gmel. xiv, . . 228
Piceus Rve. xiv, . . 226
Pictus Bean, xiv, . . 41
Pictus Blv. xv, . . 88
Pictus Rve. xiv, . . 211
Picus Rve. xiv, . . 111
Placiphora Cpr. xiv, . . 311
PLACIPHORELLA Cpr. xiv, 305
Placophora Dall, xiv, . 311
PLACOPHOROPSIS Pils. xiv, 313
Planatus Spengl. xv, . 68
Platessa Gld. xiv, . . 49
Platymerus Sowb. xv, . 115
Platysemus Midd. xiv, . xvii
PLAXIPHORA Gray, xiv, . 311
Plumeus Cpr. xv, . . 33
Plumosa Cpr. xiv, . . 298
Plumosus Gld. xiv, . . 329
Pœciloplax Th. xv, . . 88
Polii Desh. xiv, . . 181
Polii Phil. xiv, . . 284
Politus Speng. xiv, . . 186
Polychetus Blv. xv, . . 30
Polyophtalmus Roch. xiv, . 236
Porifera Pils. xiv, . . 297
Porochiton Fisch. xiv, . xxi
Porosus Burrow, xv, . . 36
Porphyreticus Rv. xv, . 39
Porphyrius Sowb. xiv, . 323
Porrecta Cpr. xv, . . 19
Prasinatus Cpr. xiv, . 34
Princeps Cpr. xiv, . . 50
Productus Cpr. xiv, . . 26
Productus Rv. xiv, . . 57
Proprius Rv. xiv, . . 111
Proteus Rve. xiv, . . 91
Pruinosum Roch. xv, . 109
Pruinosus Gld. xiv, . . 109
Pseudodentiens Cpr. xiv, . 74
Ptygmata Roch. xv, . 97
Pulchellus Cpr. xiv, . . 266
Pulchellus Gray, xiv, . 271
Pulchellus Phil. xiv, . 182
Pulcherrimus Sowb. xiv, . 130
Pulchrior Cpr. xiv, . . 272
Pulvinatus Cpr. xiv, . . 179
Punctatus Ström, xiv, . 41
Punctatus Whiteaves, xv, . 78
Puncticulatus Rv. xiv, 248, 258
Punctulata Kr. xiv, . . 100
Punctulatus Leach, xiv, . 49
Punctulatissimus Sowb. xiv, 115
Puniceus Couth. xiv, . . 81
Purpurascens Ad. xiv, . 58
Purpurascens Ad. xv, . 75
Pusillus Sowb. xiv, . 80
Pusio Sowb. xiv, 133; xv, . 88
Pustulatus Kr. xv, . 73
Pygmæus Pils. xv, . . 23

Quatrefagei Roch. xv, . 96
Quercinus Gld. xiv, . 248
Quoyi Desh. xiv, . . 172

Radians Cpr. xv, . . 75
RADSIA Gray, xiv, . 151, 189
RADSIELLA Pils. xiv, . 139
Radsiella Thiele xv, . . 74
Rarinota Jeffr. xv, . . 93
Raripilosus Blv. xv, . . 116
Rawakana Roch. xv, . . 91
Regularis Cpr. xiv, . . 142
Reteporosus Cpr. xv, . . 77
Reticulatus Rv. xiv, . 101
Retiporosus Cpr. xiv, . 75
Retusus Sowb. xiv, . . 288
Rissoi Payr. xiv, . . 102
Roseus Blv. xv, . . 30
Roseus Sowb. xiv, . . 113
Rostratus Rv. xv, . . 53
Rhodeus Pils. xv, . . 26
Rhodoplax Thiele xv, . 74
Rhopalopleura Th. xv, . 91
Rhygophilum Roch. xv, . 93
Rhynchotus Roch. xv, . 100
Rhyssoplax Th. xv, . . 69
Rubellus Cpr. xiv, . . 182
Rubellus Nardo, xiv, . 181
Ruber L. xiv, 80; xv, . 65
Ruber Speng. xiv, . . 41
Rubicundus Costa xiv, . 182
Rubiginosa Hutt. xv, . . 107
Rubridens Pils. xiv, . . 202
Rubrolineatus Lisch. xv, . 18
Rubrotincta Cpr. xiv, . 26

Rudis Hutt. xiv, . . 238
Ruficostatus Cpr. xiv, . . 38
Rugatus Cpr. xiv, . . 11
Rugosa Sowb. xiv, . . 290
Rugulatus Sowb. xiv, 110; xv, . . . 81
Rugulosus Ang. xiv, . . 249
Rugulosus Sowb. xv, . . 114
Rusticus Desh. xiv, . . 186

Saccharina Dall, xv, . . 66
Sagrinatus Couth. xiv, . 71
Salamander Speng. xiv, . 228
Sanguineus Dh. xv, . 67
Sanguineus Rv. xiv, . 57
Sarcophagus Cpr. xiv, . 274
Savatieri Roch. xiv, . 317
Savignyi Pils. xiv, . . 277
Scaber Blv. xv, . . . 31
Scaber Chem. xiv, . . 156
Scaber Rv. xiv, . . 280
Scabra Cpr. xiv, . . 280
Scabra Rv. xiv, . . 280
Scabricostatus Cpr. xiv, . 121
Scabricostatus Cpr. xv, . 76
Scabriculus Sowb. xiv, . 33
Scabridus Jeffr. xv, . . 94
Scarabæus Rv. xiv, . . 158
SCHIZOCHITON Gray, xiv, [233, 234
SCHIZOPLAX Dall, xiv, . 46
Schrammi Shuttlew. xiv, . 205
SCLEROCHITON Cpr. xiv, [151, 188
Scoticus Leach, xiv, . . 14
Scrobiculatus Midd. xiv, . 76
Sculptus Sowb. xiv, . 92
Scutiger Ads. & Rv. xv, . 20
Scytoderma Sc. xiv, . 182
Scytodesma Scac. xv, . 89
Segmentatus Rv. xiv, . 38
Semilævis Cpr. xiv, . . 184
Semisculptus Pils. xiv, . 247
Senegalensis Roch. xv, . 95
Septemvalvis Mont. xiv, . 49
Sererorum Roch. xv, . . 96
Serpens Cpr. xv, . . 60
Serratus Cpr. xv, . . 78
Setiger King, xiv, . . 316
Setosus Sowb. xiv, . . 292
Setosus Tiles. xv, . . 114
Setulosum Cpr. xiv, . . 20
Shuttleworthianus Pils. xiv, 273
Siculoides Cpr. xiv, . . 179
Siculus Gray, xiv, . . 180
Simplex Cpr. xiv, . . 320
Simpsoni Gray, xiv, . . 300
Smaragdinus Ang. xiv, . 137
Sinclairi Gray, xiv, . . 174
Sinuata Cpr. xv, . . 303
Sinudentatus Cpr. xiv, . 128
Sitkensis Midd. xiv, . . 44
Sitkensis Rv. xv, . . 49
Solea Sowb. xiv, . . 98
Solidior Cpr. xiv, . . 76
Solidus Cpr. xiv, . . 64
Sowerbiana Rv. xiv, . . 39
Sowerbianus Rv. xiv, . 39
Sowerbyanus Rv. xiv, . 39
Sowerbyi Cpr. xiv, . . 92
Sowerbyi Rv. xiv, . . 39
Sparsus Sowb. xiv, . . 197
Speciosus Ad. & Ang. xiv, 93, 95
Speciosus H. Ad. xv, . 32
Spengleri Blv. xv, . . 88
Spiciferus Roch. xv, . . 109
Spiculosus Rv. xv, . . 22
Spiniferus Fremb. xiv, . 219
Spinigera Sow. xiv, . 222
Spiniger Sow. xiv, . . 221
Spinosus Brug. xiv, . . 220
Spinulosa Gray, xiv, . . 38
Spinulosus Gray, xiv, . 38
SPONGIOCHITON Cpr. xiv, 26; xv, ... 7
SPONGIORADSIA Pils. xv, . 65
Squalidus Ad. xiv, . . 291
Squammulosus Dollf. xiv, . 181
Squamosus Chem. xiv, . 157
Squamosus Linn. xiv, 155; xv, ... 88
Squamosus of authors, xiv, 154
Squamosus Pol. Payr. *et al.*, xiv, ... 180

Squamulosus Ad. xiv, . 106
Stangeri Rv. xiv, . . 177
Stectoplax Cpr. xv, . . 9
Steinenii Pffr. . . . 82
Stelleri Midd. xv, . . 48
STENOCHITON Ad. & Ang. xiv, ... 55
STENOPLAX Cpr. xiv, . 56
STENORADSIA Cpr. xiv, . 61
Stenosemus Midd. xiv, xvii
Stercorarius Roch. xv, . 29
Stereochiton Cpr. xiv, 52; xv, ... 68
Stereoplax Thiele xv, . 74
Stewartianus Roch. xv, . 37
Stigma Costa, xv, . . 95
Stimpsoniella Cpr. xv, . 92
Stimpsonii Gld. xiv, . . 307
Stokesii Brod. xiv, . . 165
Stramineus Sowb. xiv, . 79
Streptochiton Cpr. xiv, . 330
Stretochiton xv, . . 19
Striatosquamosus Cpr. xiv, 168
Striatus Barnes xiv, . 161
Striatus Chier. xiv, . . 181
Striatus Lam. xv, . . 53
Striatus of authors, xiv, . 163
Striolatus Gray, xiv, . 105
Strigatus Sowb. xv, . . 60
Stygma Roch, xv, . . 27
Subassimilis Souv. xv, . 99
Subatrata Pils. xiv, . . 201
Subcariosa Cpr. xiv, . . 143
Subcariosus Pils. xiv, . 67
Subclathratus Pils. xiv, . 124
Subfuscus Sowb. xiv, . . 162
Subgigas Blv. xiv, . . 256
Submarmorea Midd. xiv, . 42
Sueurii Blv. xv, . . 30
Sulcatus Q. & G. xiv, . 138
Sulcatus Risso. xiv, . . 2
Sulcatus Risso. xiv, . . 180
Sulcatus Wood, xiv, 192; xv, ... 89
Suezensis Rv. xiv, . . 206
Superba Cpr. xiv, . . 319
Swainsoni Sowb. xiv, . . 201
Swannii Cpr. xiv, . . 304
Symmetrogephyrus Midd. xv, 43
Sypharochiton Th. xv, . 88

Tectum Blv. xv, . . 103
Tehuelchus Orb. xiv, . 205
Tehuelchus d'Orb. xv, . 71
Tenuisculptus Cpr. xiv, . 112
Tenuistriatus Sowb. xiv, . 188
Terminalis Cpr. xiv, . 326
Tessellata Pils. xiv, . 243
Tessellatus Q. & G. xiv, . 138
Tessellatus Wood, xiv, 154, 157
Testudinarius Blv. xv, . 104
Testudo Speng. xv, . . 92
Tetrica Cpr. xiv, . . 287
Textilis Gray, xiv, . . 98
Textilis Nutt. xv, . . 114
Thalassinus Gm. xv, . . 116
Thouarsiana Roch. xv, . 114
Tigrinus Kr. xiv, . . 143
Tigris Speng. xiv, . . 156
Tomochiton Fisch. xiv, xxi
TONICELLA Cpr. xiv, 40, xv, 66
TONICIA Gray, xiv, . 149, 194
Toniciella Th. xv, . . 66
Toniciopsis Th. xv, . . 89
Torresianus Roch. xv, . 58
Tortuosus Cpr. xiv, . . 331
TRACHYDERMON Cpr. xv, . 62
TRACHYRADSIA Cpr, xv, . 68
Tridacna Roch. xv, . . 41
Tridentatus Pils. xiv, . 140
Trifidus Cpr. xv, . . 86
Tristis Roch. xv, . . 28
Tropicalis Dall, xiv, . . 19
Truncatus Sow. xiv, . . 211
Tuberculatus L. xiv, . 153
Tuberculatus Schroet. xiv, . 228
Tuberculiferus Sowb. xiv, . 219
Tuberculosus Souv. xv, . 99
Tulipa Q. & G. . . 185
Tunicata Wood, xv, . . 41
Turgidus Roch. xv, . . 29

Unciniferus Roch. xv, . 59
Undatus Speng. xiv, . 154
Undulatus Q. & G. xiv, . 245
Undulatus Sowb. xv, . 115

REESE LIBRARY OF THE UNIVERSITY OF

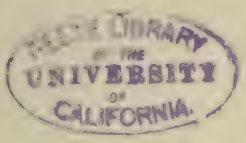
Unguiculatus Blainv. xiv, . 228
Unicolor Pils. xiv, . . 144
Urvillei Roch. xv, . . 102
Ustulatus Rve. xiv, . . 96

Vaillantii Roch. xv, . 97
Variabilis Ad. & Ang. xv, . 101
Variegatus Ad. & Ang. xv, 102
Variegatus Phil. xiv, . . 69
Velata Cpr. xiv, . . 306
Velatus Sowb. xv, . . 72
Veneris Roch. xv, . . 112
Veredentiens Cpr. xiv, . 122
Vermiformis Blv. xv, . 57
Versicolor Ad. xiv, . . 50
Versicolor Sowb. xv, . . 114
Vespertinus Gld. xiv, . 300
Vestitus Sowb. xv, . . 43
Violacea Nord. xv, 49, 50
Violaceus Q. & G., . . 39
Virescens Rv. xiv, . . 78
Virgatus Rv. xiv, 78; xv, . 82
Virgulatus Sowb. xiv, . 166
Viridior Cpr. xiv, . . 108
Viridis Pse. xv, . . 21
Viridis Q. & G. xiv, . . 172
Viridis Speng. xiv, . . 156
Viridulus Couth. xiv, . 141
Volvox Rv. xiv, . . 237
Vulgaris Leach. xv, . . 10

Wahlbergi Kr. xiv, . 322
Watsoni Sowb. xv, . . 72
Wosnessenskii Midd. xiv, . 305

Yerburyi Sm. xiv, . . 101

Zealandicus auct. xv, . 16
Zelandicus Q. & G. xv, . 16
Zigzag Hutt. xiv, . . 328
Zonatus Blv. xv, . . 115
Zschaui Pffr. xiv, . . 204



ORDER OPISTHOBRANCHIATA.

Suborder *TECTIBRANCHIATA.*

Hermaphrodite, Opisthobranchiate, Gastropods, with one branchial plume situated on the right side; mantle and shell developed.

This suborder differs from the *Nudibranchiata* in the asymmetrical unpaired gill, the development of a mantle and shell, etc. It is a synthetic type, from which in the remote past, the *Nudibranchiata* and *Pulmonata* have no doubt been derived.

Fischer has proposed a classification of this group which seems to be the best yet published covering the entire suborder. In the following pages his general arrangement is followed; but with numerous minor modifications. The group is primarily divided into three sections, whose characteristic features are well expressed in their names:

I. Cephalaspidea: Head with a fleshy disc or shield. (*Bulla*, etc.).

II. Anaspidea: No head-disc nor dorsal shield. (*Aplysia*, etc.)

III. Notaspidea: no head disc; back protected by a large shield or notæum, and by a true mantle and shell. (*Umbrella*, etc.)

The first of these sections will now be considered.

I. Tectibranchiata Cephalaspidea.

"All of these animals are characterized by the presence of a head-disc, distinct from the back, bearing the sessile eyes and the tentacles when present. This disc appears to be a tactile organ. It varies in many ways, furnishing good characters for classification. Sometimes it is split behind into two tentacle-like projections. Morphologically it is considered according to Cuvier, to be formed by the united buccal tentacles and the upper tentacles or rhinophores. The shell nearly always is present, but in some cases is rudimentary.

It generally has an entire aperture, but a short basal canal is formed in the *Ringiculidæ*."

Dr. Fischer, from whom we take the above paragraph, divides the *Cephalaspidea* into families as follows:

- Operculata — *Actæonidæ.*
- Inoperculata
  - Shell external
    - No radula — *Tornatinidæ.*
    - Radula present
      - *Scaphandridæ.*
      - *Bullidæ.*
      - *Aplustridæ.*
      - *Ringiculidæ.*
  - Shell internal
    - Radula present
      - *Gastropteridæ.*
      - *Philinidæ.*
    - No radula — *Doridiidæ.*

This grouping is open to some objections, for it places *Actæonidæ*, one of the least differentiated, primitive families, next in the linear series to *Tornatinidæ*, one of the most divergent; but until the soft parts of a number of the other types are better known, it will be advisable to retain Fischer's arrangement. In the more ancient, primitive forms the radula is wide, with many rows of similar teeth; in the divergent groups the radula is often reduced to few longitudinal rows (as in tænioglossate and rhachiglossate Pectinibranchs), and the teeth of each transverse series are dissimilar in form. The shell, originally well coiled, has become degenerate and partially uncoiled in numerous distinct genera.

Family ACTÆONIDÆ Fischer.

Actæonidæ Orbigny (in part).—Meek, Amer. Journ. Science (2), xxxv, p. 84, 1863.—Fischer, Man. de Conch., p. 551.—*Conf.* Bouvier, Ann. Mag. Nat. Hist. (6), xi, p. 441, etc.

Shell entirely external and capable of containing the entire animal; spiral, with projecting or depressed spire and moderately numerous whorls, the internal whorl-partitions not absorbed; surface generally sculptured with spiral punctured grooves. Aperture rounded below, with or without columellar folds. Provided with an operculum.

Animal having a well-developed head-disk, bearing the sessile eyes, and prolonged in two triangular processes behind; lateral epipodial lobes not developed; radula composed of many longitudinal rows of teeth, all of the same form.

Synopsis of Genera.

a. Columella provided with a spiral fold.

b. Genus SOLIDULA Fischer. Shell compact, solid, ovoid, with short spire; aperture long, narrow above, the columella bearing a massive, bifid fold.

bb. Genus ACTÆON Montf. Shell compact, with short spire and large, ovate body-whorl; aperture over half the length of the shell, narrowed above, the columella bearing a single, simple, spiral fold.

c. S.-g. Actæon Montf. Columella curving regularly into the basal lip.

cc. S.-g. Rictaxis Dall. Columella obliquely truncated at base.

bbb. Genus LEUCOTINA A. Ad. Shell ovate or ovate-turrited, the spire produced; aperture short, generally less than half the shell's length, ovate or oblong; columella with a small oblique fold.

aa. Columella with no distinct spiral fold above; shell imperforate or nearly so.

b. Genus ACTÆONINA Orb. Shell shaped like *Actæon*, ovate, with elongated aperture, the columella with no fold above, not truncated at base; whorls more or less angulated below the sutures.

bb. Genus BULLINA Fér. Shell ovate or oblong, with short spire and long aperture; columella vertical, truncated at base.

bbb. Genus OVULACTÆON Dall. Shell Cypræiform, involute, with an apical perforation as in *Bulla*. Aperture narrow, as long as the shell; columella without plaits.

aaa. Columella without plaits. Umbilicus open; surface cancellated.

b. Genus KLEINELLA A. Ad. Shell ovate, umbilicate, surface cancellated; spire produced; aperture elongated, angular behind, produced and entire in front. A doubtful member of this family.

Genus SOLIDULA Fischer de Waldheim, 1807.

Solidula F. de W., Mus. Demidoff, iii, 1807, p. 226, type *Voluta solidula* Linn.—A. Ad., P. Z. S., 1854, p. 60.—*Dactylus* Schum., Essai, etc., p. 70, 234, 1817, type *Voluta solidula* Linné.—*Buccin-*

ulus H. & A. ADAMS, Gen. Rec. Moll., ii, p. 5, 1858. Not of *Plancus*.—*Tornatella* of authors.

Shell ovate or oblong, solid, compact and imperforate, with short, conical spire. Aperture two-thirds as long as the shell or more, narrow above, rounded below, the *columella bearing a massive bilobed spiral fold*, outwardly curving into the lower margin of the peristome; parietal wall bearing one or more smaller folds. Operculum (pl. 49, figs. 17, 18) "transverse, elongated, curved, with imbricate elements and a linear scar." Type *S. solidula* L.

Anatomy and dentition unknown. This genus differs from *Actæon* by its more solid shell, and massive, bilobed, columellar fold. The species are all from subtropical and southern temperate Indo-Pacific seas; a few species extending northward to Japan, and others south to South Australia and New Zealand. The Americas have as yet furnished no species.

This group has usually borne the name *Buccinulus*, introduced into binomial literature by the Adams' brothers. Plancus, in his original publication "Jani Planci Ariminensis de Conchis minus notis, etc.," (Venice, 1739), gives the phrase-name "*Buccinulus Littoris Ariminensis Olivæ Nucleum æmulans*" to what is probably a discolored *Actæon tornatilis*, for no other shell of that aspect is found in the Adriatic, and at all events it is a form with absolutely simple columellar fold. In the second edition (Rome, 1760) it is called "*Buccinum medium maculis fuscis et flavis donatum ex littore Ariminensi*," but in the explanation of plates he repeats the earlier comparison with an olive stone. Of course the "Buccinulus" is not used in a generic sense. Schumacher's name *Dactylus* had previously been used by both Klein and Humphrey, but not in an acceptable manner.

S. STRIGOSA Gould. Pl. 20A, figs. 60, 61.

Shell ellipsoidal, elongated, rather solid, grooved by revolving punctured sulci, the interspaces chain-patterned with brown and whitish, and ornamented with median, sutural and basal bands of whitish. Whorls 5, the last three-fourths the length of the shell. Aperture two-thirds the length of the shell, very narrow; columella deeply excavated. Alt. 8, diam. 3 mill. (*Gld.*)

Loo Choo and Kagosima (Stimp.); *Nagasaki* (Birileff); *Tokyo Harbor* (Fr. Stearns).

Buccinulus strigosus GOULD, Proc. Bost. Soc. Nat. Hist. vii, p. 141 (October, 1859); Otia Conch., p. 114.—*Tornatella strigosa* LISCHKE, Jap. Meeres-Conchyl. ii, p. 104, pl. 5, f. 12, 13.

Remarkable for its small size and slender form. Some specimens are much shorter than others, and nearly without the slaty lines; so that the species appears to be quite variable. (*Gld.*)

Lischke has figured this species. His specimens have four spiral cords on the penultimate, 20–21 on the last whorl. The fifth and sixth cords from the suture are much wider than the others, especially than the adjacent cords. The upper fold on the columella is small, the lower strong and split by a deep groove; between the teeth the columella is deeply excavated.

S. FRATERCULUS Dunker. Pl. 20A, figs. 53, 54.

Shell small, solid, ovate-oblong, subcylindrical, transversely, evenly sulcate; banded and dotted with ashy or brown, with two encircling white bands. Spire conic, terminating in a somewhat obtuse apex; columella bearing two white folds, the larger, anterior one bipartite, separated by a deep sinus from the smaller, posterior fold. Aperture dilated, thickened, in front, the lip acute.

Alt. 12, diam. 5 mill. (*Dkr.*)

Japan.

Buccinulus fraterculus DKR., Index Moll. Mar. Jap., p. 161, pl. 13, f. 21, 22, 23.

A larger, slenderer shell than *B. strigosus* Gld., having two white bands, and 30–32 spiral grooves.

S. ACUTA Philippi.

Shell sublanceolate, transversely closely punctate-sulcate. Spire acute, two-fifths the total length. Aperture narrow, columella biplicate, the upper fold minute, the lower large, bifid.

Alt. 2¾, diam. 1⅓ lines. (*Phil.*)

China (coll. Largilliert).

Tornatella acuta PH., Zeitschr. f. Mal., 1851, p. 125.

There are about 5 coarsely punctate grooves on the penultimate, about 20 on the last whorl. Columellar folds exactly as in *T. solidula*. The specimen is white, quite colorless.

S. PUSILLA A. Adams.

Shell ovate-conic, small, white, solid, shining; spire exserted, the apex obtuse; transversely deeply sulcate, the grooves distant, cancellated; aperture elongated, narrow behind; columella biplicate, the posterior fold tubercle-shaped, the anterior fold bilobed. (*Ad.*).

Catbalonga, Samar, Philippines, in 8 fms. (Cuming).

Solidula pusilla AD., P. Z. S., 1854, p. 61.

This is a small white solid species, resembling in appearance the *Actæon oryza* of Reeve; but the columella is biplicate, and the front plica is double. (*Ad.*)

S. INSCULPTA Reeve. Pl. 20A, fig. 51.

Shell ovate, transversely very densely punctured-grooved throughout; whitish rather obscurely sprinkled with ruddy rose spots; suture rather indistinct. Columella two-plaited, upper plait rather obscure, lower prominent, duplicate. (*Rve.*).

Island of Masbate, Philippines (Cuming).

Tornatella insculpta RVE., P. Z. S. 1842, p. 62; Conch. Syst., ii, pl. 206, f. 2; Conch. Icon. xv, pl. 3, f. 15.

A strongly sculptured species, with the sutures less developed than usual, prettily sprinkled with ruddy rose. (*Rve.*)

S. SUTURALIS A. Adams. Pl. 20A, figs. 65, ~~66, 67.~~

Shell cylindrical-ovate with elevated spire; whorls rather flattened, angulated above, the sutures channelled; white, frequently tessellated with ashy spots, longitudinally striated, transversely lirate, the interstices cancellated. Columella uniplicate, the fold bilobed. (*Ad.*)

Luzon (Cuming); *Puerto Galero, Mindoro* (Cuming); *Evans Bay, Cape York, North-eastern Australia*, in 6 fms. (*Braz.*).

Solidula suturalis AD., P. Z. S. 1854, p. 61.—*Tornatella suturalis* REEVE, Conch. Icon., xv, pl. 2, f. 9.—COOKE, Ann. Mag. N. H. (5), xvii, p. 128.—*Buccinulus suturalis* BRAZIER, Proc. Linn. Soc. N. S. Wales, ii, p. 77.

In this species the hind tubercle usually present in *Solidula*, is wanting. The color varies from pure white to grayish, with gray tessellated markings. The chief peculiarity of the species consists in the canaliculated suture of the whorls. (*Ad.*)

S. TESSELLATA Reeve. Pl. 20A, figs. 42, 43.

Shell somewhat cylindrically ovate; transversely irregularly punctured-grooved; white, tessellated with flesh-tinted spots; apex sharp, columella two-plaited, the upper plait nearly obsolete. (*Rve.*)

Red Sea (Rüppell).

Tornatella tessellata RVE., P. Z. S. 1842, p. 60; Conch. Syst. ii, pl. 206, f. 3; Conch. Icon. xv, f. 6.—ISSEL, Mal. Mar Rosso, p. 173.—*Actæon* (*Buccinulus*) *tessellatus* COOKE, Ann. Mag. N. H. (5), xvii, p. 128.

S. CINEREA Watson. Pl. 20A, figs. 49, 50.

Shell strong, oblong, pointed at both ends, white with three spiral bands of cindery spots; a high, conical, sharp-pointed spire, barely convex spirally striated whorls, a slight suture, a long narrow mouth emarginate in front, and a strongly twisted double toothed pillar. Sculpture: Longitudinals—there are fine, approximate, hair-like, obsolete lines of growth. Spirals—there are shallow square-cut furrows formed of small contiguous oval pit-marks; of these there are on the penultimate whorl about 8, on the body about 25; the flat raised surface of the shell between is from one to three times as wide as the furrows. On the first two whorls these furrows are wanting; on the third whorl only one appears close below the suture. Color porcellanous and glossy white, with three narrowish-grey bands, made up of small, cindery, somewhat longitudinally arranged spots; these bands, absent on the earlier whorls, first make their appearance on the fifth, from which to the seventh there is only one band immediately above the suture; its upper edge is somewhat indefinite, flame-like expansions of it extending upwards here and there. On the body another similar band occurs at the periphery; and a third is on the base originating just above the upper pillar-tooth; the two latter are more defined than the first; the cindery spots forming these bands are entirely absent in the furrows. Spire short and conical; apex small and sharp, the minute tip being distinctly prominent and not in the least twisted or inverted. Suture slight, being scarcely impressed; in the earlier whorls it is very horizontal, but latterly it is oblique. Mouth long, narrow, curved in toward the axis of the shell, sharply pointed above, channelled in front of the pillar point. Outer lip sinuated above; lip edge roundly prominent at the periphery, where it is patulous, hardly curved, and in direction oblique. On the base it is extremely

patulous, a little pointed, very curved and retreating, at the point of the pillar it is very strongly emarginate. Inner lip: the glaze on the body is not very thick, and has a defined edge which does not extend beyond the mouth; near the point of the base it is swelled into a small, narrow, blunt, oblique tooth, and at the point of the pillar it forms a very strong, twisted, oblique double tooth which dies out very speedily, and does not connect itself with the mouth-edge; the furrow above the double tooth is very strong. Alt. 0.4 in.; diam. 0.14. Penultimate whorl, height 0.06. Mouth, height 0.28, breadth 0.08 inch. (*Wats.*)

Levuku, Fiji, in 12 fms.

Actæon (*Buccinulus*) *cinereus* Wats., Chall. Rep. Gastr., p. 631, pl. 47, f. 5.

This pretty little species is very like *Actæon* (*Buccinulus*) *glaber* (Reeve), but has a higher and sharper spire, a much feebler, less channelled suture, and lacks the sculpture on the upper whorls, which in *Actæon* (*Buccinulus*) *glaber* are harshly pitted up to the very apex. These three smooth apical whorls are very peculiar, and distinguish the Challenger species from *Actæon* (*Buccinulus*) *strigosus* (Gould), from Japan, the coarse apex of which is strongly sculptured. In that species, too, the upper tooth on the pillar is very feeble. My note on the British Museum Buccinuli was that some of them seemed not well individualized, especially in the case of the various specimens of *Actæon glaber* (Reeve), *Actæon affinis* (A. Adams), and *Actæon fumatus* (Reeve), and, further, that *Actæon cinereus* Wats., seemed to agree with two specimens of *Actæon glaber* on different tablets, the one from Fiji, the other from "Sandy Cape." Mr. Edgar A. Smith, who kindly compared the species for me, confirms this opinion. Writing on May 2, 1882, he says, "We have this shell marked *Actæon glaber var.* from Japan, but it is probably distinct from that species.

S. affinis A. Adams. Pl. 20A, fig. 52.

Shell cylindrical-ovate, the spire acuminate, apex acute. Buff-white, frequently variedly painted, tessellated with subquadrate, irregular, blackish spots. Transversely sulcate, the grooves crenulated, unequal, rather distant. Columellar biplicate, the posterior fold obsolete, the anterior bilobed. (*Ad.*)

China Seas; New Ireland; Borneo; Philippines (Cuming); *Port Jackson* (Challenger); *Darnley Island, Torres Strait* (Brazier); *Moonta Bay, S. Australia* (Tate).

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Solidula affinis A. Ad., P. Z. S., 1854, p. 61.—*Buccinulus affinis* Angas, P. Z. S. 1867, p. 225.—Brazier, Proc. Linn. Soc. N. S. Wales, ii, p. 77.—Tate, Trans. Roy. Soc. S. Austr. 1893, p. 202.—*Actæon* (*Buccinulus*) *affinis* Watson, Challenger, Gastrop., p. 630, pl. 47, f. 1.

More slender and elongated than *B. solidulus*, very finely tessellated with brown or black on a white ground, having sometimes one or two white bands. (*Braz.*)

S. solidula Linné. Pl. 20A, figs. 37, 38, 44, 45.

Shell solid, oval, with conical, acute spire and obese body-whorl. Surface spirally grooved throughout with impressed spirals, the intervals mostly convex and cord-like; the last whorl having about 21 grooves; *those on the median part hardly more widely spaced* than above and below. White, with *close vertical chocolate stripes*, occasionally broken into tessellation in places, and interrupted by two narrow white spiral bands. Aperture narrow above, the outer lip thin, interior of aperture very heavily calloused. Columella having a strong, bifid spiral fold, with *a single small parietal fold* above it, so deep-seated that it can scarcely be seen in a front view of the shell. Alt. 23½ diam. 12 mill.

Philippine Is. (Cuming); *Seychelles, Amirantes and Mauritius* (Martens); *Natal* (Sowb.); *Friday Island* (Coppinger) *and Darnley Island, Torres Straits; Princess Charlotte Bay, N.-E. Australia*; *Noumea, New Caledonia* (Braz.).

Bulla solidula Linn, Syst. Nat. (10), p. 728; Mus. Lud. Ulr Reg. etc., p. 590.—*Voluta solidula* Linn., Syst. Nat. (12), p. 1187, and of Gmelin, Syst. Nat. (13), p. 3437 (excl. ref.).—*Bulimus solidulus* Brug., Encycl. Méth., no. 68.—*Tornatella solidula* Fer., Tab. Syst., p. 108.—Lam., An. s. Vert. vi, p. 220.—Kiener, Iconogr. Coq. Viv.. p. 4, pl. 1, f. 2.—Reeve, Conch. Syst., ii, pl. 206, f. 7; Conch. Icon. xv, f. 3.—Martens, Möbius' Reise n. Mauritius, p. 302.—Smith, Zool. Coll. Alert, p. 86.—*Buccinulus solidulus* Brazier, Proc. Linn. Soc. N. S. Wales ii, p. 76.—*A. solidulus* Sowb., Sh. S. Afric., p. 52.

In this species the spiral grooves are deeper and more evenly spaced than in the next; the color-pattern, even when most interrupted, consists of solid, dark stripes or checkers; and the parietal fold is single and deep-seated.

Mr. Smith considers Reeve's *T. coccinata* a variety, and *S. affinis* A. Ad., he regards as a small form of this species.

Var. COCCINATA Reeve. Pl. 20A, figs. 40, 41.

Large, with short, concave-sided spire; white, profusely sprinkled with scarlet dots.

Cagayan, Mindanao, Philippines, in 25 fms. (Cuming).

Tornatella coccinata RVE., P. Z. S. 1842, p. 60; Conch. Syst. ii, pl. 206, f. 10; Conch. Icon. xv, f. 1.

Has been reported by Cooke (Ann. Mag. N. H. (5), xvii, p. 128) from Suez.

S. SULCATA Gmelin. Pl. 20A, figs. 39, 46, 47, 48.

Shell solid, oval, with short conical spire and large body-whorl. Surface spirally grooved throughout, the grooves rather shallow, *separated by wider intervals on the median part of the body-whorl*, about 21 in number. White, *closely speckled and checkered in an irregular, ragged pattern with mingled tawny and black.* Aperture narrow and long, heavily calloused within; columella bearing a large, squarish, entering bifid fold, the parietal wall above it armed with a smaller transverse fold, *above which are usually several smaller denticles.*

Alt. 23, diam. 12 mill. (Negros, Philippines).

Alt. 16, diam. 8 mill. (Singapore).

Negros, Philippines (Cuming); *Seychelles, Mauritius and Red Sea* (Martens); *Palm Island, N.-E. Australia; Sue and Darnley Is., Torres Sts.; Anse Vata, nr. Noumea, N. Caledonia* (Brazier); *Singapore* (Archer.); *Tahiti.*

Voluta sulcata GMEL., Syst. Nat. (13), p. 3436.—*Tornatella punctata* FER., Tab. Syst., p. 108.—*Tornatella glabra* REEVE, P. Z. S. 1842, p. 60; Conch. Syst. ii, pl. 206, f. 12; Conch. Icon. xv, pl. 1, f. 4.—*Solidula glabra* AD., P. Z. S. 1854, p. 61.—*Buccinulus glaber* BRAZIER, Proc. Linn. Soc. N. S. Wales, ii, p. 76.—*Tornatella sulcata* MARTENS, in Möbius' Reise nach Mauritius, p. 302.

This species is subject to great mutations of form, *size* and coloring. The smallest before me are from Tahiti, measuring 12 mill. in alt., having very little tawny coloring; a blackish or ashy speckling predominates.

The ragged, bicolored markings, and the (usual) plurality of parietal teeth, as well as the wider spacing of the grooves about the median part of the large whorl, are all characters easily sundering this species from the foregoing. The spiral grooves are distinctly pitted on the spire.

S. OBLONGA Menke.

Shell elliptical-oblong, cylindrical, rather solid, shining, transversely sulcate and very delicately striated, longitudinally obsoletely striated. Spire conical, acute. Whorls 6, slightly convex. Aperture narrow; columella biplicate, the lower fold large, bilobed, the lower lobe smaller; whitish pallidly tesselated with square punctate spots. Alt. 7.7, diam. 3 lines. (*Mke.*)

Habitat unknown.

Actæon oblongus MKE., Mal. Bl. i, p. 27.

Most nearly allied to *A. punctatus* (Tornatella p., Fér., Tabl. 2, p. 108, no. 5), but differing in being slenderer, with more pointed spire, fine transverse striation, and in the peculiar coloration of crowded pale brick-red punctate dice-spots. The last whorl has 15 unequally spaced grooves, of which the third, fourth and fifth bound the widest intervals; the lower grooves are closest. The penultimate whorl has three grooves. The columellar fold is the same in the two species.

S. NITIDULA Lamarck. Pl. 20A, fig. 57.

Shell solid, oval, with very short spire, mamillar apex and obese body-whorl; shining, polished, light flesh-pink. Surface smooth except for a few spiral grooves at the base. Whorls about 7. Aperture narrow, three-fourths the entire length of the shell, the outer lip very thick within, bevelled to a sharp edge; columella bearing a very large massive spiral fold, with a small fold of callus above it on the parietal wall. Alt. 17, diam. 10 mill.

Singapore; Bohol (Cuming); *Bet Island, Torres Strait; Noumea, New Caledonia*; *New Ireland; New Britain, Duke of York Is.* (Brazier); *Réunion; Mauritius; Seychelles* (Martens); *Sandwich Is.* (Newcomb).

Tornatella nitidula LAM., An. s. Vert. vi, p. 221.—KIENER, Iconogr. Coq. Viv., fig. 5.—RVE., Conch. Icon., pl. 2, f. 5.—MARTENS in Möbius' Reise n. Mauritius, p. 302.—*Solidula nitidula* AD., P. Z. S. 1854, p. 61.—*Buccinulus nitidulus* BRAZ., Proc. Linn. Soc. N. S. Wales, ii, p. 77.

This polished, compact species is distinguished by the smoothness and delicate flesh color of its polished surface, and the massive, projecting columellar fold. It seems to be widely distributed in Indo-Pacific waters.

S. FUMATA Reeve. Pl. 20A, fig. above fig. 51.

Shell narrowly ovate, transversely densely linearly grooved throughout; fulvous white, irregularly smeared with black; spire rather exserted; columella two-plaited, the lower plait strongly duplicate. (*Rve.*)

Australia.

Tornatella fumata RVE., Conch. Icon., xv, pl. 3, f. 10.

The disposition of the coloring matter, which is not an unimportant feature in this genus, is in longitudinal smears, not arising, as in varieties of *T. solidula*, from confusion in a normal pattern of dots. (*Rve.*)

S. ALVEOLA Souverbie. Pl. 18, figs. 84, 85.

Shell ovate-conic, spirally and inequidistantly striate-punctate; white spotted with fleshy-rose color, the spots square, situated on the spaces between the striæ, arranged in transverse rows, and wanting on the fourth and eighth spaces; spire exserted, conic-acute; whorls 8, the last nearly two-thirds the total length; aperture oblong, narrow above; columella biplicate, the larger fold sub-bilobed.

Alt. 11, diam. 5 mill.; aperture, alt. 7 mill. (*Souv.*).

Island of Art, New Caledonia.

Tornatella alveola SOUV., Journ. de Conchyl. 1863, p. 167, pl. 5, f. 9.

In the single example from which this species was described, the fourth space between punctured striæ is double the width of the adjacent spaces.

S. INTERMEDIA Angas. Pl. 20A, figs. 55, 56.

Shell elongately ovate, solid, shining, white, painted with two bands of irregular descending brown flames and spots; spire acuminate, pointed at the apex, the same length as the aperture; whorls 6½, encircled by numerous grooved and finely punctured striæ, that become obsolete on the centre of the last whorl; sutures strongly impressed; outer lip simple, thin, non-arcuate; columella with a strong bilobed fold near the base, and a smaller projecting plate above it; inner lip with a broad spreading callus. (*Ang.*).

Alt. 9, diam. 3 mill.

Aldinga Bay, S. Australia (Angas).

Buccinulus intermedius ANG., P. Z. S. 1878, p. 862, pl. 54, f. 11.

This, the only species of *Buccinulus* as yet discovered in South Australia, is allied to *B. affinis* A. Ad., from New South Wales, from which it differs somewhat in form, and also in the style of coloration. (*Ang.*)

S. NIVEA Angas. Pl. 20A, fig. 62.

Shell elongately ovate, rather solid, white, shining; spire acuminate, pointed at the apex; whorls 7½, encircled by numerous unequal, irregular, impressed and finely punctured striæ, which become fewer towards the upper whorls; sutures impressed; outer lip thin, a little sinuous, arcuate; columella with a prominent bilobed fold near the lower part, and a single small one above; inner lip covered by a spreading callus. Alt. 12½, diam. 4¾ mill. (*Ang.*).

Sow and Pigs reef, Port Jackson, New South Wales (Brazier).

Buccinulus niveus ANGAS, P. Z. S. 1871, p. 19, 97, pl. 1, fig. 27.

S. KIRKI Hutton. *Unfigured.*

Whorls 6, finely and rather distantly spirally grooved, those on the center of the whorls rather farther apart; columella with one double fold; white.

Length 20, breadth 7½ mill. (*Hutton*).

Omaha, New Zealand.

Buccinulus kirki HUTTON, Catal. Mar. Moll. N. Z., p. 51, 1873; Journ. de Conchyl. 1878, p. 40; Man. N. Z. Moll., p. 119, 1880.

S. ALBA Hutton. Pl. 18, fig. 94.

Whorls 7, rather deeply transversely grooved and lightly longitudinally striated, the striæ showing distinctly in the grooves. Columella with a broad double anterior fold, and a smaller posterior one. Length 15, breadth 7 mill. (*Hutton.*)

Auckland; also in pliocene at Wanganui, New Zealand.

Buccinulus albus HUTTON, Catal. Mar. Moll. N. Z. p. 51; Journ. de Conchyl. 1878, p. 40; Man. N. Z. Moll., p. 119.—*Tornatella alba* HUTTON, The Pliocene Mollusca of New Zealand, p. 37, pl. 6, f. 2. (Macleay Memorial Volume.)

S. GRACILIS Kirk. *Unfigured.*

Whorls 8, finely and closely spirally grooved. Body whorl rather constricted in the middle; the spiral grooves are much finer at the anterior end of the whorl, and as they approach the lip, which is

very thin and sharp, white. Length ·85 inch. Breadth ·37 inch. (*Kirk*).

Wellington, New Zealand. Collected by Mr. C. Hollsworth.

Buccinulus gracilis KIRK, Trans. N. Z. Institute xiv, p. 268, 1881.

This shell is easily distinguished from *Buccinulus kirki* Hutton, (the type of which is in the Colonial Museum), by the greater number of whorls, its more elongate and less robust appearance, and by the greater number and closer proximity of the spiral grooves. (*Kirk*).

S. HUTTONI Kirk. *Unfigured.*

Whorls 6, with numerous fine spiral grooves. Columella with double fold, but more prominent than in the preceding species. Spire very short, giving a decidedly robust appearance to the shell. Ground color, white with longitudinal brown wavy lines. (*Kirk*).

Waikanae, New Zealand.

Buccinulus huttoni KIRK, Tr. N. Z. Inst. xiv, p. 268.

Genus ACTÆON Montfort, 1810.

Acteon MONTF., Conch. Syst. ii, p. 314.—*Actæon* A. ADAMS, P. Z. S. 1854, p. 58. Not *Actæon* Oken, 1815,=*Elysia* Risso.—*Tornatella* LAMARCK, Extr. du Cours de Zool. du Mus. d'Hist. Nat., etc., p. 117, 1812; Anim. s. Vert. vi, p. 219, 1822.—REEVE, Conch. Icon. xv, and of other authors.—*Speo* RISSO, Hist. Nat. Eur. Mérid. iv, p. 235, 1826.—*Conf.* PHILIPPI, Archiv. für. Naturg. 1841, p. 55, pl. 5, f. 10 (animal).—SARS, Moll. Reg. Arct. Norv., p. 280, pl. xi, f. 1, (dentition), and pl. xviii, f. 57 (operculum).

Shell oval, spirally striate, with conical spire and impressed or channelled suture. Aperture long, half the shell's length or more, narrow above, broadly rounded below, the outer lip simple and acute; columella twisted into a strong, simple spiral fold. Parietal wall without folds or teeth. Operculum corneous, shaped like the aperture, few-whorled with nucleus near the basal margin. Type *A. tornatilis* L.

Animal having the cephalic shield squared in front, produced behind in two triangular appendages, in front of the bases of which the eyes are situated. Radula wide, with many longitudinal rows

of teeth, all of the same form, consisting of a narrow basal-plate and a crescentic reflexion (pl. 49, fig. 1, 2, 3, *A. tornatilis*).

Distribution world wide. The genus as here restricted contains Actæonidæ with one undivided spiral columellar fold, and no teeth upon the inner lip above that fold, the aperture being narrow above and more than half the total length of the shell. Two subgenera, or better, sections, may be recognized among the recent species; for the fossil groups see Structural and Systematic Conchology, ii. p. 356.

Section ACTÆON.

Shell with a single columellar plait, which passes continuously into the anterior margin of the peristome.

Section RICTAXIS Dall.

Shell like *Actæon*, but with a slight prominence or oblique truncation at the base of the columella.

Section ACTÆON Montf., 1810.

A. MARIÆ A. Adams. Pl. 19, fig. 13.

Shell ovate-cyclindrical, spire obtuse; longitudinally substriate, transversely lirate, the liræ with an impressed median groove, interstices closely latticed; dull white, ornamented with two transverse ashy bands. Aperture oblong, columella uniplicate. (*Ad.*).

China Seas (Mus. Cuming).

A. mariæ AD., P. Z. S. 1854, p. 60.—*Tornatella mariæ* RVE., Conch. Icon., xv, f. 22.

In this species the whorls are ornamented with two spiral, transverse ash-colored bands and the liræ are double, each being divided in the middle by a fine transverse groove. (*Ad.*).

A. SIEBALDII Reeve. Pl. 19, figs. 18, 19.

Shell ovately conical, transversely densely striated throughout; livid ruddy color, banded with white at the sutures. Columella oneplaited. (*Rve.*).

Japan (Siebald).

Tornatella siebaldii REEVE, P. Z. S. 1842, p. 61; Conch. Icon. xv, pl. 3, f. 11.

No additional specimens have been obtained and Reeve suspects it to be a variety of *A. tornatilis*.

A. SECALE Gould.

Shell small, elongate-ovate, thin, straw-colored, polished above, with a subsutural engraved line, below encircled with punctate striæ, whorls 4, tabulated, the last three-fourths the length of the shell. Apex obtuse. Aperture slightly exceeding half the shell's length, ear-shaped, acute behind, well rounded in front; columella conspicuously twisted. Alt. 4, diam. 2 mill. (*Gld.*).

China Seas (Stimpson).

Actæon secale GLD., Proc. Bost. Soc. N. H. vii, p. 141; Otia Conch., p. 113.

A. MINUTUS Petterd.

Shell minute, ovate, white, shining, pellucid. Spire small. Whorls 4, flattened. Apex mamillate. Transversely striate with fine waved striæ, and faintly longitudinally striate. Aperture long, narrow, expanded at base; columellar fold conspicuous; outer lip a little thickened. Alt. 2, diam. 1 mill. (*Pet.*).

Forneaux Group, Bass Straits (R. M. Johnson).

Tornatella minuta PETTERD, Journ. of Conch., Leeds, ii, p. 105, 1879.

A. AUSTRINUS Watson. Pl. 20, figs. 24, 25, 26.

Shell small, thin, ovate, strongly striated, with a high conical spire, blunt tip, and tumid body-whorl. Sculpture: Longitudinals —the lines of growth are very faint and somewhat markedly oblique. Spirals—the whole surface is scored with strong equal furrows which are about half the breadth of the interstices; these furrow are not stippled, but are delicately and regularly cut across on the lines of growth by fine threads; there are about 20 of these furrows on the body and about 9 on the penultimate whorl. Colour porcellanous, with a glossy surface. Spire rather high, conical, subscalar. Apex rather large, blunt and flattened, with a very slight inversion of the extreme tip. Whorls nearly 5, very little convex; the last is rather large and somewhat tumid. Suture rather oblique, slight, scarcely impressed. Mouth oval, pointed above, a little oblique in its direction. Outer lip sharp and thin, with its edge crenulated by the sculptural spirals; in direction it is straight above, well curved on the base, where it is very slightly emarginate. Inner lip: very

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slightly convex on the body, it passes gradually into the short concave pillar, at the base of which there is only the faintest trace of a tooth; its edge is sharp and patulous, with a minute chink behind it. Alt. 0·18 in.; diam. 0·1. Penultimate whorl, height 0·06. Mouth, height 0·11, breadth 0·07 inch. (*Wats.*).

Off Moncœur Island, Bass' Strait, 38–40 fms.

A. austrinus Wats. J. L. S. Lond. xv, p. 286; Chall. Gastr. p. 628, pl. 47, f. 3.

This species slightly resembles *Actæon pusillus* (Forbes), from the Mediterranean and North Atlantic; but the spirals in that species are stronger, and are pit marked; the suture is much stronger and more channelled, and the body whorl is more barrel-shaped. (*Wats.*).

A. fabreanus Crosse. Pl. 18, figs. 86, 87.

Shell slightly rimate-perforate, ovate-globose rather thin but somewhat solid, a little shining; transversely sculptured with numerous, regular flat sulci, the interstices longitudinally very delicately lirate. Whitish, longitudinally marbled with violet-brown. Spire moderately elevated, the apex subacute; suture deeply impressed, subcanaliculate. Whorls 7, the two embryonal smooth, whitish, the following a trifle convex; last whorl exceeding the spire in the proportion of 8 : 2⅓, attenuated toward the base. Aperture oblong pear-shaped, whitish within; peristome simple; columellar margin thickened, with one fold, livid white, outwardly rounded, acute. Alt. 10½, diam. 6 mill. Aperture scarcely 8 mill. long, 3 wide. (*Cr.*).

Yo, New Caledonia (Balansa).

Tornatella fabreana Crosse, Journ. de Conch. 1873, p. 66, 130, pl. 5, f. 4.

Allied to *A. pudicus*, but more globose, the spire shorter, and distinguished by its color and the lirate intervals between the riblets. (*Cr.*).

A. pudicus A. Adams. Pl. 19, figs. 20, 21.

Shell oval, subcylindrical, subumbilicate, solid; dull whitish, a little flesh tinted. Spire a little elevated. Whorls convex, transversely grooved, the grooves equal, punctate. Aperture oblong; columella strongly uniplicate. (*Ad.*).

Cagayan, Mindanao, Philippines (Cuming).

A. pudicus AD., P. Z. S. 1854, p. 60.—*Tornatella pudica* REEVE, Conch. Icon. xv, pl. 3, f. 13.

Described from one dead specimen.

A. VIRGATUS Reeve. Pl. 20A, figs. 63, 64.

Shell stoutly ovate; transversely finely linearly grooved throughout; ivory-white, conspicuously obliquely streaked with black; spire short, rather obtuse, apex sharp; columella one-plaited. (*Rve.*).

Masbate, Philippines, in 7 fms. (Cuming).

Tornatella virgata RVE., P. Z. S. 1842, p. 60; Conch. Syst. ii, pl. 206, f. 8, 9; Conch. Icon. xv, pl. 2, f. 8.

A. FLAMMEUS Gmelin. Pl. 20A, figs. 58, 59.

Shell stoutly ovate, closely and densely punctured-grooved throughout; white, streaked with reddish flames or crescent-shaped spots. Spire rather short. Columella strongly one-plaited. (*Rve.*).

Java; *Islands of Ticao and Correjidor, Philippines,* in 7 fms. (Cuming); *off Nukalofa, Tongatabu,* 18 fms.; *Levuka, Fiji,* 12 fms.; *Off southwest point of Papua,* 28 fms. (Challenger); *Torres Strai.* (Brazier); *East Africa, Querimber Is. and Mauritius* (Martens).

Voluta flammea GMEL., Syst. Nat. xiii, p. 3435 (excl. var.).—*Bulimus variegatus* BRUG., Encycl. Méth. vers, i, p. 336, pl. 452, f. 1 (*Tornatella flammea*).—*Tornatella flammea* LAM., An. s. Vert. vi, p. 219.—SOWB., Genera, ii, f. 1.—KIENER, Coq. Viv. *Torn.*, p. 1, pl. 1, f. 1.—REEVE, Conch. Icon. xv, pl. 1, f. 2.—MARTENS, Moll. Mauritius, in Möbius' Reise, p. 303; Monatsber. Berl. Akad. 1879, p. 739.—*Actæon flammeus* A. AD., P. Z. S. 1854, p. 59.—BRAZIER, Proc. Linn. Soc. N. Wales, ii, 1878, p. 75.—WATSON, Chall. Rep. Gastr., p. 626.

The young shell has an umbilical chink.

A. ORYZA Reeve. Pl. 18, fig. 82.

Shell ovate, rather solid, transversely linearly grooved throughout; ivory white; columella rather prominently one-plaited. (*Rve.*).

Catbalonga, Luzon, Philippines (Cuming); *Mauritius* (Lienard); *Réunion* (Desh.).

Tornatella oryza RVE., P. Z. S. 1842, p. 62; Conch. Icon. xv, pl. 4, f. 18.—DESH., Catal. Moll. Réunion, p. 57.—MARTENS, in Möbius' Reise n. Mauritius, p. 302.

A. ALBUS Sowerby. Pl. 18, fig. 81.

Shell oblong-ovate, subpellucid, white, transversely punctate-sulcate throughout. Suture impressed. Aperture elongate-ovate; columella with one fold. (*Sowb.*).

Port Elizabeth, S. Africa.

Tornatella alba SOWB., P. Z. S. 1873, p. 720, pl. 59, f. 6; Journ. of Conch. 1886, v, p. 15.—*Actæon albus* SOWB., Marine Sh. S. Af., p. 51.

A pure white semitransparent species, regularly grooved and beautifully punctured throughout. (*Sowb.*).

A. SEMISCULPTUS Smith. Pl. 18, fig. 97.

Shell ovate, turrited, small, shining, snow-white; very narrowly rimate; smooth above, rather distantly puncto-striate transversely below the middle, and on the base more closely striated; sculptured longitudinally with a few indistinct, distant sulci. Whorls 4, lightly convex, separated by a narrow channelled suture. Apex involute. Aperture inversely ear-shaped, a little more than half the shell's length; columella narrowly reflexed, bearing a small fold at the rimation. Alt. 4, diam. 2·25 mill. (*Sm.*).

St. Helena.

A. semisculptus E. A. SMITH, P. Z. S. 1890, p. 298, pl. 24, f. 8.

The spiral transverse punctured striæ do not extend above the middle of the body-whorl. The longitudinal narrow and shallow indistinct sulci apparently indicate lines of growth. (*S.*).

A. SENEGALENSIS Petit. Pl. 18, figs. 90, 91.

Shell elongated, cylindrical, thin, subpellucid, white. Spire turrited, acute. Whorls 7, regularly transversely striated. Columella obliquely uniplicate. Length 17, diam. 6 mill. (*Petit.*).

Mouth of the Gambia River, W. Africa.

Tornatella senegalensis PETIT, Journ. de Conchyl. ii, p. 262, pl. 8, f. 3.—REEVE, Conch. Icon. xv, pl. 3, f. 14.

The elongated form, thinness of the shell, and the obliquity of the columellar fold are the distinguishing features of this form.

A. TORNATILIS Linné. Pl. 19, figs. 7–11, 15.

Shell long-ovate, with conical acute spire and impressed sutures the whorls but little convex. Color pinkish with a light girdle

edged with dark at the shoulder and another at the lower third of the body-whorl; the latter or both girdles often absent. Whorls about 8, sculptured with close, fine, engraved spiral lines, punctate at their bottoms, the base having coarser liræ with delicately latticed interstices. Last whorl about three-fourths the shell's length. Aperture narrow, two-thirds the shell's length; columella concave below, having one stout oblique fold above.

Alt. 19, diam. 10 mill.

Entire Mediterranean and Adriatic Seas; Atlantic from Norway to Morocco, in laminarian and coralline zones.

Voluta tornatilis LINNE, Syst. Nat. xii, p. 1187, (1766).—HANLEY, Ipsa L. Conch., p. 212.—*Turbo ovalis* DACOSTA, Brit. Conch., p. 101, pl. 8, f. 2 (1778).—*Bulimus tornatilis* BRUG., Dict. Encyc., p. 338 (1789).—*Voluta bifasciata* GMEL., Syst. Nat. xiii, p. 3436.—*Tornatella fasciata* LAM., An. s. Vert. vi, p. 220 (1822).—KIENER, Coq. Viv., p. 5, pl. 1, f. 3.—FORBES & HANL., Brit. Moll. iii, p. 523, pl. 114, f. 3, pl. vv, f. 7.—*Speo tornatilis* RISSO, Hist. Nat. Eur. Mérid. iv, p. 236.—*Speo bifasciatus* RISSO, *l. c.*—*Tornatella tornatilis* PHIL., Enum. Moll. Sicil. ii, p. 143.—REEVE, Conch. Icon. xv, pl. 1, f. 7.—*Actæon tornatilis* MONTFORT, Conch. Syst. ii, p. 315 (1810).—H. & A. AD., Gen. Rec. Moll. ii, p. 4, pl. 56, f. I.—JEFFREYS, Brit. Conch. iv, p. 433; v, p. 224, pl. 95, f. 2.—HIDALGO, Mol. Mar. Esp., pl. 19, f. 3, 4; pl. 20*c*, f. 1.—SARS, Moll. Reg. Arct. Norv., p. 280, pl. 17, f. 11.—BUQ., DAUTZ. & DOLLF., Moll. Rouss. i, p. 510, pl. 66, f. 15–19.

This species is the type of the genera *Acteon*, *Tornatella* and *Speo*. It is a common and widely dispersed European form. The following varieties and named color-mutations are recognized by the authors of "Les Mollusques marins du Roussillon."

Var. *minor* Monts.

Var. *subulata* Searles Wood. Pl. 19, fig. 14. Elongated, narrow, with elevated spire. Originally described as a fossil (Crag Mollusca i, p. 170, pl. 19, f. 7), it has been found living off the English coast.

Var. *tenella* Lovén. Small, with thin, subpellucid shell, more shining than in the type (Index Moll. Scand., p. 11).

Var. *bullæformis* Jeffr. Small, regularly oval, with very short spire (Brit. Conch. iv, p. 435).

Var. *albobifasciata* Monts. Two upper bands only present.

Var. *fascia-unica-alba* Scac. Shoulder band only present.

Var. *unicolor* Scac. (*efasciata* Monts.). Uniform grayish roseate, without bands (pl. 19, f. 10).

A. AMABILIS Watson. Pl. 20, figs. 27, 28.

Shell small, ovate, white, with flattened whorls, a subscalar spire, a very blunt apex, a pear-shaped smallish mouth, and a very slight tooth on the pillar. Sculpture: Longitudinals—there are very faint hair-like lines of growth. Spirals—there are on the last whorl about 20, on the penultimate whorl about 8 rather strong and equal furrows stippled with roundish oval pits; they become more crowded and weaker toward the middle of the base; just below the suture the first furrow is minutely and slightly beaded, and it with the next one or two is strong and these are crowded; the flat surface which parts them is somewhat broader than the furrows. Color translucent and subglossy white. Spire conical, high, scarcely scalar. Apex blunt and truncated; the extreme tip is a very little inverted. Whorls 5, very slightly shouldered just below the suture; round the top there is a very feeble constriction; below this the whorl is conical, and in profile flat on the sides; the last whorl is a very little tumid with a produced base. Suture very little oblique, strongish and well marked, but not channelled. Mouth pear-shaped, pointed above, a little oblique in direction, patulous or very slightly guttered in front of the pillar point. Outer lip straight and parallel to the axis, and a little contracted above, arched and patulous in front. Inner lip slightly convex on the body, on which there is a thin but distinct glaze with a defined edge; there is a slight angulation at the junction of the body and the pillar, near the top of which is a very faint tooth amounting to no more than a slight swelling; the pillar itself is very slightly oblique, and is straight, narrow with a sharp edge behind which is a very slight and shallow furrow. Alt. 0·16 in.; diam. 0·1. Penultimate whorl height 0·04. Mouth height 0·08, breadth 0·05. (*Wats.*).

West of Azores, 1000 fms.; *off Palma, Canaries*, 1125 fms.

A. amabilis WATS., J. L. S. Lond. xvii, p. 287; Chall. Gastr., p. 629, pl. 47, f. 4.

This species is a little like *Actæon austrinus* Watson; but compared to that the form is slimmer, the whorls are more laterally compressed and less convex, the shell is smaller, and the apex is more truncated. It a good deal resembles *Actæon levidensis* S.

Wood, but has a shorter body-whorl and mouth; the rise of the whorls in the spire is more scalar, and the apex is stumpier, with a coarser tip. (*Wats.*).

A. MONTEROSATOI Dautzenberg. Pl. 19, figs. 1, 2, 3.

Shell 5½ mill. high, 3 mill. broad, ovate-elongated. Spire conoid. Whorls 5, convex, transversely sculptured throughout with punctate striæ. Last whorl obese. Aperture pear-shaped; columella straight, hardly folded; outer lip arcuate. Color dull white. (*Dautz.*).

Pico, Azores, in 1287 meters, one example.

A. monterosatoi DAUTZ., Rés. Camp. Sci. Albert Ist., i, p. 20, pl. 1, f. 2*a*–2*d*., 1889.

This species is allied to *A. pusillus* Fbs., but in that form the columella is twisted and the spire less tapering.

A. LUTEOFASCIATUS Mühlfeldt. Pl. 49, fig. 4.

Shell ovate, ventricose, smooth; white with three buff bands; the columella with one fold. Base weakly, obliquely striated; whorls 4. Alt. 2 to 3 mill.

Rimini, Adriatic Sea, in shell-sand.

Voluta luteo-fasciata MEG. v. MUHLF., Verhandl. der Gesellsch. Naturforschender Freunde zu Berlin, i, pt. 4, p. 205, pl. 7, f. 2, 1829.

I have no knowledge of this species except from the original description. It seems to have been overlooked by writers on Mediterrean shells.

A. GLOBULINUS Forbes.

Shell white, globose; spire short; whorls 4, spirally striated, the striæ numerous and simple; aperture pyriform, columella thickened. Length 2½ mill. (*Fbs.*).

Aegean Sea, 0–95 fms. (*Fbs.*); *Mediterranean* 92 fms. (Monts.); *Off San Miguel, Azores,* 1000 fms. (Chall.).

Tornatella globulina FORBES, Rep. Aeg. Inv., p. 191.—*Actæon globulinus* JEFFR., Ann. Mag. N. H. (4), vi, p. 85.—MONTS., Enum., p. 50.—SEGUENZA, Form. Terz. Calab., p. 251.—WATSON, Chall. Rep. Gastr., p. 627.

A. PUSILLUS (Forbes) Jeffreys.

Shell ovate-globose, whitish; whorls 4, regularly and deeply punctate-striate; aperture oblong. Length 4, breadth 2 mill. (*Fbs.*).

Lycia; Naxia (Forbes); *Palermo and San Vito*, 90–210 fms. (Monts.); *Off Havana*, 450 fms. (Sigsbee); *off Sand Key*, 111 fms. (Blake); *off Sombrero* I., 450 fms. (Chall.); *Madeira* 20–50 fms. (Watson).

Tornatella pusilla FORBES, Rep. Aeg. Invert., Rep. Brit. Asso. Adv. Sci. 1843, p. 191.—*Actæon pusilla* JEFFR., Ann. Mag. N. H. (4), vi, p. 84; *l. c.* (5), x, p. 34.—MONTEROSATO Enumerazione, etc., p. 50; Journ. de Conchyl. 1878, p. 160 (*A.* "*pupillus*").—SEGUENZA, Form. Terz. Calab. p. 251.—WATSON, Chall. Rep. Gastr., p. 627.—DALL., Blake Gastr., p. 39.

This species has not, I believe, been figured.

A. EXILIS Jeffreys. Pl. 19, figs. 4, 5, 6.

Shell oblong or somewhat spindle-shaped, semitransparent, and glossy: sculpture, numerous spiral striæ or impressed lines, which are quite smooth or plain, instead of being punctate as in other species of this genus; color clear white; spire elongated, with a blunt apex: whorls three moderately convex; the last occupies three-fourths of the spire; the first is mammiform; suture distinct, margined; mouth rather narrow, irregularly pear-shaped, expanded at the base; length three-fifths of the shell; outer lip gently curved, and folding inwards; inner lip folded back on the lower part; pillar flexuous; fold strong and conspicuous. (*Jeffr.*).

Alt. 4·7 mill.

Mediterranean Sea, 92–1465 fms.; *Bay of Biscay*, 227–924 fms.; *N. Atlantic*, 227–1456 fms. (Jeffr.); *off Fayal*, 450–500 fms. (Challenger); *Off e. coast Florida*, 150–200 fms. *and Campeche Bank, Gulf of Mexico*, 200 fms. (Rush); *Off Martha's Vineyard*, 312–487 fms. (Verrill).

Actæon exilis JEFFR., Ann. Mag. N. H. (4), vi, p. 85, 1870.—WATSON, Chall. Rep. Gastr. p. 625, 1886.—DALL, Blake Rep. Gastr. p. 38, 1889.—DAUTZENBERG, Résultats Campagnes Sci. le Prince Albert I, i, p. 20, pl. 1, f. 1.—*Auriculina insculpta* VERRILL, Proc. U. S. Nat. Mus. iii, p. 381, 1880.—*Actæon nitidus* VERRILL, Tr. Conn. Acad. v, p. 540, pl. 58, f. 21, 1882.—? *A. nitidus* SEG., Form. Terz. Calab., p. 251.

A more slender form than others of this region. The synonymous *A. nitidus* is represented by fig. 4, of pl. 19. Figs. 5, 6 represent a specimen dredged by the Hirondelle, off Azores.

A. PUNCTOSTRIATUS Adams. Pl. 19, figs. 22, 23; pl. 18, figs. 98, 99.

They vary from pure white to trifasciate with rose or livid brown, usually faint and nebulous. The height of the spire, elevation of the nucleus, and extent of shell covered by the punctate lines, vary in the different specimens. Usually the spire is rather elevated, nucleus somewhat depressed, and the punctate grooves cover about half of the last whorl. There may be one or several subsutural lines, the middle of the whorl is generally smooth and free from lines, and the anterior part crowded. The northern ones are variegated like those from the Antilles, but the latter are more frequently bright colored. The very young, like those figured by Adams and Orbigny, are usually white or translucent. The colors, when banded, are nearly always rather nebulous, and the number of bands never exceeds three, the anterior one most often absent. The shell is is always thin, and often nearly translucent. (*Dall*).

Alt. 3–6 mill.

Buzzard's Bay, Mass., to Florida, Cuba and San Domingo, 2–63 fms.

Tornatella punctostriata C. B. AD., Bost. Journ. N. H. iii, p. 323, pl. 3, f. 9, 1840.—GLD., Inv. Mass. p. 245, f. 188, 1841; edit. BINNEY, p. 224, f. 515, 1870.—RVE., C. Icon. xv, pl. 4, f. 17.—*Actæon punctostriatus* STIMP., Shells of N. Engl., p. 51, 1851.—VERRILL, Inv. Anim. Vineyard Sd., p. 664, pl. 25, f. 165, 1874; Trans. Conn. Acad. vi, p. 467, pl. 45, f. 17 (var.).—DALL, Rep. Blake Gastr., p. 40.—*Actæon cubensis* GABB, Top. Geol. San Domingo, p. 245, 1873. —MORCH, Mal. Bl. xxii, p. 170, 1875.—*Tornatella punctata* ORB., Moll. Cuba i, p. 230, pl. 17, f. 10–12, 1842 (not of Lea nor Piétte).

The synonymous *T. punctata* Orb. is represented on pl. 18, fig. 98, 99.

A. TURRITUS Watson. Pl. 20, figs. 29, 30.

Shell strongish, oblong, pale yellow, translucent, somewhat glossy, with a high conical coarsely tipped spire and rounded striated whorls. Sculpture: Longitudinals—there are many feeble lines of growth. Spirals—the surface of the shell is scored with narrow shallow, irregular, unequal, distant furrows formed by hardly con-

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tinuous stipplings, which are round on the upper and oblong on the last whorl; between these furrows there often occurs a weaker one formed in the same way; on the base they are small and crowded; toward the upper suture they are strong; on the first in particular they are so. Colour: the shell itself is translucent white, but is covered with very thin yellow membranaceous epidermis. Spire high, conical, and scalar. Apex very coarse and blunt, slightly immersed, but not inverted. Whorls 6, rounded above, cylindrical below; the last is short and slightly tumid. Suture very little oblique, strong and somewhat channelled. Mouth oval to pear-shaped. Outer lip leaves the body at a right angle; it is regularly arched throughout, patulous in front. Inner lip: a thin defined glaze crosses the body and runs direct down the pillar with a straight sharp edge, behind which is a minute chink; the tooth, which is close up to the body, is very slight and blunt. Alt. 0·31 in.; diam. 0·18. Penultimate whorl, height 0·08. Mouth, height 0·17, breadth 0·1. (*Wats.*).

Off Culebra Island, West Indies, 390 fms. (*Challenger*).

A. turritus Wats., Journ. Linn. Soc. Lond. xvii, p. 285; Chall. Rep. Gastr., p. 628, pl. 47, f. 2.—*Conf.* Dall, Blake Rep. Gastr., p. 40.

This species is represented by only one specimen, of which the outer lip is somewhat broken. The spire is extremely high and scalar. In this respect, and in the rounded form of the whorls it somewhat resembles *Actæon* (*Solidula*) *suturalis* A. Adams; but the apex is much blunter, and the sculpture much finer than in that species. (*Wats.*).

A. melampoides Dall. Pl. 20, fig. 33.

Shell short, stout with a depressed spire and shouldered last whorl; white, with five whorls, sculptured with punctate spiral lines; nucleus small, eroded; other whorls with two, three, or (on the last) twenty to twenty-five spiral lines, which are distinctly punctate, with about ten punctations in the length of a millimeter; the spirals are crowded just in advance of the suture and near the pillar, and especially distant on the shoulder of the last whorl; suture distinct, with the anterior margin finely crenulate in the last whorl; other sculpture of fine lines of growth and microscopic revolving striæ as in the last species; outer lip hardly oblique, joining the body at a wider angle than usual, owing to the shouldering

of the last whorl, thin, simple, passing imperceptibly into the short, twisted pillar which bears a single distinct fold; body whorl with only a glaze, pillar hardly or not at all thickened; aperture approximately lunate. Lon. of shell, 6·0; of last whorl, 5·25; of aperture, 4·25. Max. lat. of shell, 4·0; of aperture, 1·62 mill. (*Dall*).

Off Bahia Honda, Cuba, 310 fms. (Blake); *Off e. coast of the United States* 2574 fms. (Verrill).

Actæon melampoides DALL, Bull. M. C. Z., ix, p. 95, 1881; Blake Rep., Gastr., p. 41, pl. 17, f. 2.—*A. hebes* VERRILL, Trans. Conn. Acad. vi, p. 428, pl. 44, f. 15, 1885.

The *A. hebes*, which Dall believes to be identical, is shown in fig. 12 of pl. 19.

A. PERFORATUS Dall. Pl. 20, fig. 36.

Shell small, pointed, waxen white, with a narrow opaque yellowish band in advance of the suture, composed of about six whorls, and with a distinct umbilical perforation; nucleus eroded, small; spire with about six, or (on the last whorl) eighteen strong and very regularly and distinctly punctate grooves, the punctuations at the rate (near the aperture) of about six to a millimeter, the grooves a little more crowded anteriorly and distant posteriorly, the interspaces everywhere wider than the grooves and with no intercalary grooves or striæ whatever; transverse sculpture of faint lines of growth; aperture rounded in front, pointed behind; outer lip thin, simple, arched, and continuous with the reflected thin pillar lip, upon which a fold can hardly be made out; body with a slight glaze; umbilical perforation straight, with smooth walls, apparently very deep, and about 0·25 mm. in diameter. Lon. of shell, 7·75; of last whorl, 6·0; of aperture, 4·0. Max. lat. of shell, 4·62; of aperture, 2·0 mill. (*Dall*).

Gulf of Mexico, 805 fms. (Blake). One specimen.

A. perforatus DALL, Bull. M. C. Z., ix, p. 96; Blake Rep. Gastr. p. 42, pl. 18, f. 3.

It differs from *A. exiguus* Dkr. of the same region in its very much shorter spire and globular proportions, in its obsolete columellar fold and the strength and uniformity of its punctate sulci. The anterior part of the last whorl being a little larger than any part posterior to it, this shell has a somewhat pyriform appearance. (*Dall*).

A. DANAIDA Dall. Pl. 20, fig. 32.

Shell elongated, moderately pointed, polished, white, and having about six whorls; spiral sculpture of (on the spire) six, or (on the last whorl) over twenty-five punctate grooves, more crowded anteriorly, but with two or three coarser than the rest, just in advance of the suture; between these original grooves in the latter half of the last whorl intercalary single or double grooves appear, which are seldom quite as deep as the originals, and at first are not punctate, but at last, and especially near the anterior extreme of the shell, become nearly as well marked as the original series; transverse sculpture consisting only of lines of growth, by a peculiar thickening of certain of which when they cross the grooves the punctate appearance is produced; nucleus eroded, minute; suture appressed, distinct, but the thin appressed anterior margin seems peculiarly liable to erosion, which in some cases takes place, so as to produce the appearance of a channelled suture; whorls slightly rounded; outer lip thin, simple, somewhat produced in the middle, passing imperceptibly into the thin twisted pillar, which is slightly reflected, and bears one inconspicuous, very oblique fold; body with a thin layer of callus; aperture rounded in front, rather narrow, pointed behind: no umbilical chink in this or any of the preceding species. Lon. of shell, 11·0; of last whorl, 7·75; of aperture, 6·25. Max. lat. of shell, 5·25; of aperture, 3·0 mill. *(Dall).*

Off Tortugas, 339 fms. (Blake).

A. danaida DALL, Bull. M. C. Z. ix, p. 42, 1881; Blake Rep. Gastr., p. 42, pl. 17, f. 12.

One specimen and a fragment obtained. It is an elegant and excessively punctate species, which looks as if it might have been pelted by a shower of little coins.

A. INCISUS Dall. Pl. 20, figs. 31, 34.

Shell short, thin, inflated, waxen white, polished, with five or six whorls and a rather acute spire; nucleus minute, more or less immersed, eroded to some extent in every specimen; apical whorls smooth, polished, rounded; suture very distinct, in the majority of cases not channelled; the apical whorls with two or three distant narrow grooves across which in some cases, pass elevated lines of growth which appear nowhere else, or, if at all, only in the suture near the apex; last whorl forming the largest part of the shell, inflated, provided with ten or eleven spiral grooves, which are nearer

together anteriorly; these grooves are somewhat zigzag by exigencies of growth, but are not punctate, as in so many species; other spiral sculpture consisting of microscopically fine slightly zigzag striæ, about seventy in the width of a millimeter; transverse sculpture only of most delicate flexuous lines of growth most evident near the sutures; aperture rounded in front, pointed behind; outer lip thin, simple, arcuated toward the periphery, passing imperceptibly into the pillar; body with a slight callus joining the rather slender pillar which carries one inconspicuous fold. Lon. of shell, 9·0; of last whorl, 7·0; of aperture, 5·75. Max. lat. of shell, 5·75; of aperture, 3·0 mill. (*Dall*).

Yucatan St., off Cape San Antonio, 640 fms.

A. incisus DALL, Bull. M. C. Z. ix, p. 95; Blake Rep. Gastr., p. 42, pl. 17, f. 1, 1*b*.

In this, as in the preceding deep-water species, the fold or ridge on the columella is faint, though not entirely absent, and is best seen from the side; in fact, it is almost invisible in all, except *A. melampoides*, from in front as the figures are viewed. The columella in these figures, however, is drawn as straighter and broader than it really appears; but in these particulars it is very difficult to get a draughtsman who knows nothing of shells to catch the characteristic curves in every instance. (*Dall*).

A. EXIGUUS (Dunker) Mörch. *Unfigured.*

Shell covered-perforate, flesh colored, ovate; spire elevated, nearly half the length of the shell; last whorl with its lower half sulcate, the bottoms of the grooves punctate; spire and upper half of the body-whorl smooth; suture subcontabulate, margined by an impressed line; columellar fold strong.

Length 6½, diam. 3 mill. (*Mörch*).

Antilles (Rüse).

Actæon exiguus DKR. *mss.* MORCH, Malak. Blätter, xxii, p. 169, 1875.

Var. *ovalis* Mörch. Spire shorter, suture margined with two deep grooves. Alt. 6, diam. 3·1 mill.

A. SPLENDIDULUS Mörch. *Unfigured.*

Shell elongate-ovate, very solid, whitish, bright and shining. Whorls about 5, the last with impressed spiral lines, punctate along their bottoms, very distant in the middle of the last whorl, but toward the base becoming closer and in pairs. Sutural region smooth.

Spire elevated, with two punctate lines. Columellar fold oblique, but little projecting; lip thick. Alt. 4·75, diam. 2·25 mill.; aperture 2·75 mill. high. (*Mörch*).

St. Thomas (Rüse), one specimen.

A. splendidula Morch Malak. Blätter xxii, p. 170, 1875.

A. cumingii A. Adams. Pl. 19, figs. 16, 17.

Shell oval, subcylindrical, flesh colored; spire exserted; whorls convex, transversely sulcate, the sulci beautifully cancellated, longitudinally striated. Columella with a single fold below. Aperture white inside, the lip acute, subsinuous above. (*Ad.*).

Rio Janeiro (Martin); *Porto Rico* (Krebs); 5 *miles off Cape Florida*, in 8 fms. (Rush).

A. cumingii A. Ad., P. Z. S. 1854, p. 59.—Morch, Mal. Bl. xxii, p. 169.—Dall, Blake Rep. Moll., p. 40.—*Tornatella cumingii* Rve., Conch. Icon. xv, f. 12.—*Tornatella textilis* Guppy, Geol. Mag. 1874, p. 407, pl. 16, f. 4.

This differs from *A. delicatus* by its stumpier form, coarser and ruder subcancellate striation, more prominent fold on the columella, and particularly by its nucleus which, though small, is swollen and set on the peek of a very acute spire like a swollen terminal bud on a twig. In *delicatus* the nucleus, instead of appearing larger, is considerably smaller than the whorl in front of it, in which it is also partially immersed. (*Dall*).

A. delicatus Dall. Pl. 20, fig. 35.

Shell ovate, white, or suffused with rose pink, not in bands but generally, or in longitudinal flammules, with usually a white margin in front of the suture; there are six or seven whorls, the last more than half the length of the shell, regularly rounded and grooved by, on the last whorl, 20–30 strong, rather deep, coarsely punctate grooves between rounded interspaces; lines of growth quite preceptible, suture somewhat appressed, not channelled; aperture more than half as long as the shell; outer lip thin, inner lip hardly callous, columella straight, without any chink behind it, and bearing a single moderate fold. Nucleus small, mostly immersed in the succeeding whorl, apex not acute, surface usually not polished, but a little less coarsely sculptured than that of *A. cumingii* Adams. Lon. of the largest specimen, 10·0; max. lat. 5·6; lon. of aperture, 6·0 mill. (*Dall*).

Station 19,310 fms. (Sigsbee); *Station* 50 (*Lat.* 26° 31′ *and Lon.* 85° 53′), in 119 fms.; *Station* 290, *off Barbados*, in 73 fms., coral, bottom temperature 70° 75°,F; *and Station* 100, *off Morro Light Havana*, in 250–400 fms.; *Off Point Gallegos, eastern Patagonia*, in 50½ fms.

A. fasciatus? DALL, Bull. M. C. Z. ix, p. 94, 1881, not of Lamarck.—*A. delicatus* DALL, Blake Gastr., p. 41, pl. 17, f. 5, 1889; Proc. U. S. Nat. Mus. xii, p. 296, 1889.

The difference between the nucleus of this species and that of *A. Cumingii* is noted under the latter species. It is just possible that that it is to the present species that is to be referred the single specimen obtained by Gabb, and which he referred to *A. tornatilis*. The latter is not known from this region.

A. CURTULUS Dall. *Unfigured.*

Shell small, short, subglobular, white, not polished; surface covered with sharp, deep, close set, spiral grooves minutely punctate at bottom; whorls three, beside the prominent, polished, smooth, globular, sinistral nucleus; suture distinct, not channelled; outer lip thin, simple; body with a thin wash of callus; pillar short, thin, very much twisted, so that its outer edge presents a plait-like appearance, while the shell seems almost canaliculate, though the pillar is continuous with the basal margin; above the twisted edge and separated from it by a deep channel is a second less prominent plait; altitude of shell, 3; diameter, 2 mill. (*Dall*).

West coast of Patagonia, 122 fms. (Albatross).

A. curtulus DALL, Proc. U. S. Nat. Mus. xii, p. 296, 1889.

This little shell is mostly comprised in the last whorl and appears mature. It recalls *Stilifer*, or a small snow-white *Pedipes*, as much as anything, and is different from any recent species of the group I have seen. (*Dall*).

A. BULLATUS Gould. Pl. 49, figs. 10, 11.

Shell small, thin, smooth, whitish, covered with a most delicate straw colored epidermis. The whole surface is marked with regularly arranged, deep, linear, revolving grooves, of which there are about five on the upper whorls, and about sixteen on the principal whorl. In some parts the furrows seem to be crossed by delicate bars. The interspaces are flat. There are five whorls, which have a distinct, square shoulder; the large whorl is tumid, the upper one plane.

The aperture is lunate, about three-fifths the length of the shell. The columella, about one-third the length of the aperture, is flat, and divided by a single groove. (*Gld.*).

Alt. 6·25 diam. 4·16 mill.

Off Patagonia (U. S. Ex. Exped.).

Tornatella bullata Gld., Proc. Bost. Soc. N. H. ii, p. 251 (Dec., 1847); U. S. Expl. Exped., Moll., p. 218, f. 263*a–b*.

The following species is very closely allied to this.

A. vagabunda Mabille & Rochebrune. Pl. 18, figs. 95, 96.

Shell ovate-conic, rather thin, solid, shining, dull reddish, spirally sulcate; sulci on first whorls slightly elevated, about 5; on last whorl 20 or 22, flattened, regularly spaced. Spire elevated, conic-subpyramidal, the apex large, white, lirate, mammillate. Whorls 5½, convex separated by an impressed suture, especially the earlier ones. Last whorl large, two-thirds the entire length, slightly swollen, narrowed toward the base, and descending slowly to its termination. Aperture nearly vertical, semi-ovate; peristome nearly straight, slightly thickened, the terminations joined by a very thin white callus, outer margin well curved, simple; basal margin slightly thickened and effuse, columellar margin appressed. Columella white, thickened, twisted, divided by a superficial groove, prolonged to the base of the aperture. Alt. 9, diam. 5 mill. (*M. & R.*).

South of Cape Horn.

Tornatella vagabunda Mab. & Roch., Bull. Soc. Mal. Fr. ii, p. 208, 1885. Miss. Sci. Cap Horn, Moll., p. 12, pl. 6, fig. 2.

Separated from *Tornatella bullata* Gld. by the more elongated form, last whorl less swollen, greater number of whorls, same number of spirals on the earlier, but greater number on the last whorl; narrower aperture, with less arcuate and narrower outer lip, and stronger columella.

A. venustus d'Orbigny. Pl. 18, figs. 100, 101.

Shell elongated-cylindrical, thin, roseate, transversely striated; spire elongated, the apex obtuse; whorls 5, the last large. Aperture narrow and long; columella with one projecting fold. Length 10, diam. 3½ mill. (*Orb.*).

Payta, Peru. (Fontaine).

Tornatella venusta Orb., Voy. dans l'Amér. Mér. p. 399, pl. 56, f. 4–6.—*Actæon venusta* Orb., *t. c.*, p. 700.

A. PERCONICUS Dall. Pl. 18, fig. 83.

Shell pear-shaped or conic, with rather acute spire, polished ivory white, with four whorls beside the nucleus; transverse sculpture of incremental lines; spiral sculpture of three to five close-set, sharp, punctate grooves in front of the suture, more distant anteriorly, and a similar but more numerous and uniformly spaced series just behind the pillar, behind which again are four or five widely separated similar grooves the posterior near the periphery; between them and near the periphery, as well as behind it, are no grooves or but faint spiral obsolete striæ; suture distinct but not channelled; last whorl much the largest; outer lip straight, simple, slightly thickened; body with a moderate deposit of callus; pillar as in *A. curtulus*, but less strongly twisted and with the plait and recurved margin subequal; although the margin is continuous, there is a rather deep sulcus behind the anterior end of the pillar, corresponding to a groove, which bounds the columella callus; longitude of shell, 5; latitude, 3; longitude of aperture, 3 mill. (*Dall*).

Near Galapagos Is., in 812 fms. (Albatross).

A. perconicus DALL, Proc. U. S. Nat. Mus. xii, p. 296, pl. 12, f. 7, 1889.

This shell and the last species seem to stand in an intermediate position between *Actæon* of the typical kind and *Cinulia*. If the outer lip should eventually become much thickened, of which, however, there is no satisfactory evidence, these shells might be referred to *Cinulia*. If the *A. curtulus* recalls *Pedipes mirabilis* Muhlfeldt in its form and sculpture, *A. perconicus* recalls *P. elongatus* Dall. (*Dall*).

A. OVULUM Pfeiffer.

Shell small, ovate, shining, white; spire conic. Whorls 6, nearly flat, the last three times the length of the spire. Columella biplicate at base. Aperture entire, oblong, narrow; lip simple, widened in the middle. Length 1·66, diam. ·75 mill. (*Pfr.*).

Cuba.

Tornatella ovulum PFR., Arch. f. Naturg. vi, 1840, p. 256.—*Actæon* (*Actæonidea*?) *ovulum* MORCH, Mal. Bl. xxii, p. 170.

Dall (Blake Rep. Gastr., p. 41) remarks that this may be an immature *Marginella*.

ACTÆON AUSTRALIS Quoy & Gaim. (Astrol. ii, p. 317),=*Elysia*, in Nudibranchiata.

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Section Rictaxis Dall, 1871.

Rictaxis Dall, Amer. Journ. Conch. vii, p. 136, type *Tornatella punctocælata* Cpr.—*Actæonidea* Gabb., Proc. Acad. Nat. Sci. Philadelphia, 1872, p. 273, type *A. oryza* Gabb.

Shell like *Actæon*, but with the columella obliquely truncated at base or having a small projection there.

A. punctocælatus Carpenter. Pl. 49, figs. 24.

Shell oblong with conoidal spire; white with two broad ashy or or brown zones. Whorls 5, convex, separated by impressed and narrowly channelled sutures. Surface sculptured throughout with spiral equidistant conspicuously punctate grooves, the raised intervals smooth except for a fine engraved line along the middle of each. Grooves on body-whorl about 26. Aperture two-fifths to two-thirds the length of the shell. Columella having a spiral fold above, obliquely truncated at base.

Alt. 13·5, diam. 7 mill.

Alt. 10, diam. 4·5 mill.

Catalina Island and San Diego, California (Cooper, Gabb. *et al.*); *Monterey* (Dall).

Tornatella punctocælata Cpr., Suppl. Rep. Brit. Asso. 1863, p. 646; Journ. de Conchyl. 1865, p. 139.—*Actæon* (*Rictaxis*) *punctocælata* Dall, Amer. Journ. Conch. vii, p. 136.

This species is well distinguished by the obliquely truncated base of its columella. It occurs in the Pliocene of San Diego Bay.

Genus LEUCOTINA A. Adams, 1860.

Leucotina A. Ad., Ann. Mag. N. H. 1860, (3) v, p. 406, type *L. niphonensis*.—E. A. Smith, Proc. Zool. Soc. Lond. 1890, p. 298.—*Myonia* A. Ad., Ann. Mag. Nat. Hist. (3), v, p. 406, type *M. japonica*. Not *Myonia* Dana, Amer. Journ. Sci., iv, p. 158, 1847.—*Monoptygma* A. Ad., (in part) P. Z. S. 1851, p. 222, and in Sowb., Thes. Conch. ii, p. 816. Not *Monoptygma* Lea.

Shell ovate or elongated, usually rimate, thin, whitish, with convex whorls; sculptured with spiral punctured or subpunctate grooves. Aperture rather small, oblong, produced and rounded below, the outer lip simple or crenulated within, columella with one small oblique fold. Type *L. niphonensis* A. Ad.

Soft parts unknown. With the genus *Leucotina*, Mr. E. A. Smith unites Adams' *Myonia*, proposed for shells of somewhat more elongated contour. There seems to be no difference between the two groups of more than specific importance.

Leucotina contains shells more elongated than the true Actæons, but with a similar, though weaker, columellar fold, and the same punctured-grooved sculpture. The genus has therefore been generally held to belong to *Actæonidæ* rather than to the *Pyramidellidæ*, some members of which have a somewhat similar aspect. Fischer has constituted a group *Actæopyramis* for certain species formerly referred by Adams to *Monoptygma*, such as *A. striata* Gray, *fulva* A. Ad. and *eximia* Lischke. These seem to be quite distinct from *Leucotina;* but the other species of Adams' *Monoptygma* may, with the exception of some longitudinally ribbed forms, be referred without violence to *Leucotina*. Tryon, in the eighth volume of the MANUAL, has enlarged Fischer's group more than is justifiable, by including these Leucotinas.

L. DIANÆ A. Adams. Pl. 18, figs. 68, 69, 88, 89.

Shell ovate-conic, umbilicate, with elevated spire, the whorls convex, the last one ventricose; white; transversely strongly lirate, the interstices closely latticed. Aperture oval; columella uniplicate, the inner lip subreflexed below, outer lip crenulated. (*Ad.*).

Bay of Jedo, Japan.

Actæon dianæ AD., P. Z. S. 1854, p. 59.—*Tornatella dianæ* REEVE, Conch. Icon. xv, pl. 4, f. 19.—LISCHKE, Jap. Meeres-Conchyl. ii, p. 171; iii, p. 76.

L. GIGANTEA Dunker. Pl. 18, figs. 92, 93.

Shell ovate-turritted, white, sometimes yellowish, subsolid, transversely regularly costate [see detail fig.]. Whorls 8, convex, separated by impressed sutures, the last whorl half the length of the shell. Aperture ovate; lip somewhat thickened, sulcate within; columella sinuous, having a strong fold, the margin a little reflexed in the place of the umbilical chink, half covering it; apex somewhat obtuse. Alt. 31, diam. 14 mill.

Japan.

Odontostomia gigantea DKR., Malak. Bl. xxvi, p. 71.—*Actæon giganteus* DKR., Index Moll. Mar. Jap., p. 160, pl. 2, f. 8, 9.

The rather solid shell is encircled by regular ribs flat above and obsoletely striated, on the last whorl 22–26 in number. The intervening sulci are seen under a lens to be striated and cancellated.

L. LYRATA (Cpr.) Reeve. Pl. 18, figs. 70, 71.

Shell pyramidally turbinated, transversely prominently ridged and grooved throughout; white; spire sharply acuminated; columella but little plaited; aperture small. (*Rve.*).

Hong Kong, China.

Parthenia lyrata CPR. *MS.* in Mus. Cuming.—*Tornatella lyrata* REEVE, Conch. Icon. xv, pl. 4, f. 21, 1865.

Closely resembling *L. modesta* in form, but the surface instead of being finely linearly grooved, is closely strongly grooved and ridged (*Rve.*).

L. SULCATA A. Adams.

Shell white, solid, ovate-conic, umbilicated. Whorls 3½, a little flattened, transversely deeply sulcate, the sulci obsoletely punctate. Aperture oblong; inner lip a little straightened, furnished with a vanishing fold. (*Ad.*).

Corea Strait, 46 fms. (Ad.).

Leucotina sulcata AD., Ann. Mag. N. H.(3),viii, p. 241, Sept., 1861.

L. niphonensis A. Ad. is the nearest to this species, from which, however, it differs in being more conoidal, shorter and broader; the transverse obscurely punctate grooves, moreover, are very deep, and the umbilicus is conspicuous and open. (*Ad.*).

L. NIPHONENSIS A. Adams. Pl. 49, fig. 7.

Shell white, thin, oblong-oval; whorls 3½, a little convex, transversely sulcate, the interstices punctate. Aperture oblong, subproduced in front; inner lip with an oblique fold, scarcely conspicuous outer lip acute, simple. (*Ad.*).

16 *miles from Mino-Sima, off Niphon; Strait of Corea*, 63 fms (Ad.).

Leucotina niphonensis AD., Ann. Mag. Nat. Hist. (3), v, p. 407 —*Tornatella niphonensis* REEVE, Conch. Icon. xv, pl. 4, f. 16.

This species is the type of Adams' genus *Leucotina*.

L. EXARATA A. Adams.

Shell ovate-conic, white, umbilicated, rather solid; whorls 4½, little convex, transversely lirate, the interstices very delicately long

udinally striated. Aperture ovate, acute behind; parietal fold early median, small, oblique. (*Ad.*).

Tabu-Sima, Japan, 25 fms. (Ad.).

Leucotina exarata Ad., Ann. Mag. N. H. (3), vi, p. 421, Dec., 860.

L. INSCULPTA A. Adams.

Shell acuminate-ovate, white, perforate, rather solid, whorls 4½, a ittle convex, transversely lirate, the interstices strongly punctate. Aperture oblong, narrowed behind, dilated in front, the inner lip hickened, parietal fold nearly concealed. (*Ad.*).

Strait of Corea, 46 fms. (*Ad.*).

Leucotina insculpta A. Ad., Ann. Mag. N. H. (3), vi, p. 421; Ann. Mag. (3), viii, p. 138.

Adams republished this species, from the same locality, but with a new diagnosis, in 1861. His later description is here given:

Shell ovate-conic, rimate, white, rather solid. Spire elevated, acute. Whorls slightly convex, transversely lirate, the liræ flat, equally spaced, the interstices closely, subtly punctate. Aperture ovate; with a parietal fold above; lip subexplanate in front; umbilical region impressed, rimate. (*Ad.*).

L. PUNCTATA A. Adams.

Shell ovate, rather solid, imperforate; spire produced, acute; whorls a little flattened, transversely sulcate, the sulci deeply punctate; aperture ovate; lip somewhat thickened in front; parietal fold superior. (*Ad.*).

Tabu-Sima, Japan, 25 fms. (Ad.).

Leucotina punctata Ad., *t. c.*, p. 139.

L. JAPONICA A. Adams.

Shell turrited-subulate, white, subpellucid; whorls a little flattened, transversely sulcate, the sulci distant, interstices punctate; aperture oblong, subreflexed in front; inner lip rather straight, furnished above with a scarcely conspicuous oblique fold; outer lip sulcate within, the margin crenulated. (*Ad.*).

Strait of Corea; off Niphon (Ad.).

Myonia japonica A. Ad., Ann. Mag. N. H. (3), v, p. 406, May, 1860.

Most nearly allied to *A. lauta* A. Ad. This species is the type of the genus *Myonia* A. Ad.

L. ELEGANS A. Adams.

Shell subulate, thin, semi-opaque, graceful. Whorls 6, slightly convex, transversely sulcate, the sulci oblique, distant and punctate. Aperture ovate, acuminate posteriorly; parietal fold thin, median, oblique; lip simple. (*Ad.*).

Gulf of Pe-Chili, 5 fms. (Ad.).

Myonia elegans AD., Ann. Mag. N. H. (3), viii, p. 241, Sept., 1861.

Most like *M. punctigera* A. Ad., but more slender and transparent, with longer whorls and a thin inner lip; the transverse grooves, moreover, are not so coarsely punctate. (*Ad.*).

L. SCITULA A. Adams.

Shell subulate-ovate, white, opaque, shining. Whorls 4, a little flattened, transversely sulcate, the sulci distant, closely punctate; sutures impressed. Last whorl large, elongated. Aperture ovate, dilated in front, acuminate behind; parietal fold conspicuous, oblique, lip simple. (*Ad.*).

Mino-Sima, Japan, 63 fms. (Ad.).

Myonia scitula AD., *t. c.*, p. 242.

A small species, somewhat similar in appearance to *M. punctigera* from the Gulf of Pe-chili, but shorter and more ovate. (*Ad.*).

L. MODESTA A. Adams. Pl. 49, figs. 8, 9.

Shell elongate-conic, subpellucid, thin, white. Spire turrited-acute. Whorls slightly convex, transversely sulcate, the sulci equidistant, punctate; longitudinally striated. Aperture oval; columella oblique, uni-plicate. (*Ad.*).

Corrigidor 7 fms. (Cuming).

Actæon modestus A. AD., P. Z. S. 1854, p. 60.—*Tornatella modesta* REEVE, Conch. Icon. xv, pl. 4, f. 20.

This is an elongated, semipellucid species, resembling more a *Monoptygma* than an *Actæon*, with the spire elevated, and the plait on the columella near the hind part. (*Ad.*).

L. ESTHER Angas. Pl. 49, fig. 19,

Shell ovate, rather solid, scarcely rimate, whitish: whorls five, transversely grooved and crossed with very fine longitudinal lines;

aperture oblong-ovate, half the length of the shell; columella white straight, parietal fold hardly visible.

Length 2½ lines, breadth 1¼ lines.

Port Jackson, deep water (Coll. Angas).

Leucotina esther Ang., P. Z. S. 1867, p. 116, 225, pl. 13, f. 31.

L. sinuata Angas. Pl. 49, figs. 14, 15, 16.

Shell elongately turreted, thin, semipellucid, white, transversely striated with narrow, equidistant, opaque diaphanous lines, and crossed on the last whorl with extremely delicate longitudinal striæ; whorls 8, convex; sutures channelled; aperture ovate, angled above, rounded below; columella arcuate, a little flattened and reflected over the body-whorl; outer lip deeply sinuous above, forming a sharp angle at its junction with the last whorl, rounded and effuse below. Alt. 3½ lines, diam. 1½ lines. (*Ang.*).

Dredged on the "Sow and Pigs" reef, Port Jackson (Brazier).

Myonia sinuata Ang., P. Z. S. 1877, p. 39, pl. 5, f. 18.

Although in this shell the slight plait or twist on the columella is not discernible, it otherwise resembles a Myonia; and I have, therefore, placed it in that genus, which belongs to the *Acteonidæ*, rather than with *Monoptygma* or *Menestho*. The sinuous outer lip is a remarkable feature in this species. (*Ang.*).

L. minuta Smith. Pl. 60, fig. 17.

Shell minute, oblong, white; whorls 5, the nucleus rounded, introverted, spirally lirate; the following whorls convex, with spiral delicate liræ (about 7 on the penultimate whorl), the interstices a little narrower than the liræ and very delicately longitudinally sculptured. Aperture ovate, acuminate above; below, with the arcuate and dilated columella, slightly effuse; columellar fold central, distinct. Alt. 2½, diam. ¾ mill. Shorter variety 2¼ mill. long, 1 mill. wide. (*Smith*).

St. Helena.

Leucotina minuta E. A. Sm., P. Z. S. 1890, p. 298, pl. 24, f. 9.

The apex of this species is peculiar, being introverted as it were, and partly enveloped by the succeeding whorl. It is not smooth as is frequently the case in other species, but obliquely spirally lirate. The raised lines in the grooves between the ridges produce a subpunctate appearance. (*Sm.*).

L. ELONGATA Sowerby. Pl. 49, figs. 22, 23.

Shell elongated, white; spire turrited, very lightly convex, whorls 8, slightly convex, spirally sculptured with about 8 incised sulci, which are rather narrow, moderately deep and obscurely punctured; sutures deep. Last whorl oblong. Aperture oblong-ovate, small, the columella straight, peristome simple. Length 13, diam. 3½ mill.; aperture long. 3½, width 2¼ mill. (*Sowb.*).

Port Elizabeth, S. Africa.

Leucotina elongata SOWB., Shells of S. Africa, p. 52, pl. 11, f. 57.

A white shell, spirally grooved, of a more elongated form than the known species of the genus. (*Sowb.*).

L. PUNCTURATA Smith. See MANUAL VIII, p. 314. *Whydah, W. Africa.*

Monoptygma (*Myonia*) *puncturata* E. A. S., P. Z. S., 1871, p. 734, pl. 75, f. 16.

L. CASTA A. Adams. Pl. 18, fig. 72. See MANUAL VIII, p. 314. *Monoptygma casta* A. AD., P. Z. S., 1851, p. 223; Thes. Conch., ii, p. 818.—*Leucotina casta* SOWB., Sh. S. Africa, p. 52.—*Odostomia* (*Parthenia*) *casta* WATSON, Chall. Rep. Gastr., p. 487.—*Monoptygma concinna* AD., Thes. Conch., ii, p. 819, pl. 172, f. 34.—*Myonia concinna* ANGAS., P. Z. S., 1867, p. 225.

China Seas (Ad.); *Port Jackson* (Ang.); *Bass Strait* (Chall.); *Port Elizabeth* (Sowb.).

L. LAUTA A. Adams, pl. 18, fig. 75. See MANUAL, VIII, p. 313. *Philippines.*

L. AMOENA A. Adams, pl. 18, fig. 76. See MANUAL, VIII, p. 313. *Philippines.*

L. SPECIOSA A. Adams, pl. 18, fig. 73, 74. See MANUAL, VIII, p. 314. *Philippines.*

L. PURA A. Adams, pl. 18, fig. 77. See MANUAL, VIII, p, 314. *New Zealand.*

L. SENEGALENSIS Malzan. *Unfigured.* *Gorée.*

Actæon (*Amathis*) *senegalensis* MALZ., Nachrbl. d. m. Ges., xvii, p. 29.

Genus ACTÆONINA d'Orbigny, 1850.

Acteonina D'ORB., Prodr. Paléont. Stratigr. Universelle, etc., p. 118, 226, type *Chemnitzia carbonaria* Koninck, Descr. Anim. Foss. Carb. Belg., pl. 41, f. 15. Paléont. Française, ii, p. 161, 1850.

Shell shaped like Actæon, imperforate, oval or fusiform, with the spire prominent, but shorter than the last whorl. Whorls angular or channelled in the vicinity of the suture. Aperture long and narrow, rounded at base, the columella concave, somewhat thickened, without folds or teeth. Type *A. carbonaria* Kon.

This genus was proposed for fossil forms having the contour of a slender, long-apertured *Actæon*, but without folds upon the columellar lip. Orbigny claims the date 1847 for *Actæonina*, but it was not actually published in that year. See Prodr. Pal. Strat. Univ., i, p. lix. The genus has been restricted by Meek, who removed from it the peculiar groups *Conactæon* and *Euconactæon*. The typical forms extend from the Carboniferous to the Portlandian formation.

The two recent species referred to the genus are to be regarded as very doubtful members of it. They are more likely to be an independent group of foldless *Actæonidae* near *Bullina*, than descendants of this long extinct genus, the shells of which have a *facies* quite different.

A. EDENTULA Watson. Pl. 49, figs. 12, 13.

Shell fragile, ovate, white, with a thin, chestnut-colored epidermis, a bluntish scalar spire, a largish mouth, inner lip untoothed. Sculpture: Longitudinals—there are very many close set minute lines of growth, with here and there one much stronger than the rest, which cuts in like a fault on the spirals, interrupting their continuity. Spirals—there are many regular, but not sharp-cut nor stippled furrows which corrugate even the interior surface of the shell: about 70 of these are on the body; about 20 on the penultimate whorl. They are strongest toward the middle of the body-whorl, and somewhat faint toward the upper suture; the flat surface between them which is about thrice their breadth, is more or less distinctly scored by a very faint furrow. Color opaque white, covered with a thin, glossy chestnut-colored epidermis, which is a little darker below the suture and on the base. Spire rather high, roundedly and bluntly conical, scalar. Apex slightly eroded, but evidently blunt, large and slightly inverted. Whorls 5½, somewhat convex, of rather rapid but regular increase; the last is long and cylindrical, with a rounded produced base. Suture oblique, strong; axially impressed rather than channelled. Mouth long, transversely pear-shaped, narrowing very gradually above, open and rounded below.

Outer lip a little patulous above, a good deal so on the base; it rises from the body-whorl at a right angle but immediately bends downwards and runs forward to the base quite straight and parallel to the axis; across the base it is slightly emarginate. Inner lip: a thin, narrow glaze crosses the body and borders the pillar, which is narrow and concave, with a rounded, slightly twisted, and feebly marginated edge. There is no tooth. Alt. 1 in.; diam. 0·5. Penultimate whorl, height 0·2. Mouth, height 0·65; breadth 0·31. This fine species is represented by only one somewhat broken specimen. (*Wats.*).

Balfour Bay, Royal Sound, Kerguelen Island, 60 fms. (Challenger.)

Actæon edentulus Wats., Journ. L. Soc. Lond., xvii, p. 284.—*Actæon* (*Actæonina*) *edentulus* Wats., Chall. Rep. Gastr., p. 632, pl. 47, f. 6.

A. charlis Watson. Pl. 49, fig. 5, 6.

Shell small, ovate, thin, translucent white with flatly rounded whorls, a short subscalar very bluntly tipped spire, a largish roundish mouth, sinuated outer lip, and edentulous pillar. Sculpture: Longitudinals—there are numerous, unequal, sinuous hair-like, obsolete lines of growth. Spirals—the whole surface is scored with flattish rounded threads and shallow furrows of half their breadth between; these become feeble in the middle of the whorls; the furrows are not stippled. Color translucent-white and glossy. Spire conical, scarcely scalar. Apex extremely blunt, being suddenly truncated and flattened; the extreme tip is very slightly inverted. Whorls 4½, constricted above, flatly rounded in the middle, and very faintly constricted below; the last is very little tumid, with a rounded and slightly produced base. Suture strong, slightly oblique, impressed and slightly channelled. Mouth roundly pear-shaped, very bluntly pointed above. Outer lip: there is a strong, shallowish and wide sinus above; below this the lip edge (straight in its direction) is prominent, with a very slight emargination on the patulous and rounded base-line. Inner lip: an excessively thin and narrow glaze crosses the body, which is scarcely convex; the line of junction with the pillar and out to the point of the shell is roundly concave: the lip edge on the pillar is narrow and sharp, and there is behind it a small furrow. Alt. 0·1 in.; diam. 0·05. Penultimate whorl, height 0·02. Mouth, height 0·05; breadth 0·03 inch. (*Wats.*).

Off San Miguel, Azores, in 1000 fms. (Challenger).

Actæon (?) *chariis* Watson, Journ. Linn. Soc. Lond., xvii, p. 288.—*A.* (*Acteonina*) *chariis* Wats., Chall. Rep. Gastr., p. 633, pl. 47, f. 7.

This species is very slightly like *Actæon exilis* Jeffr., still more *Actæon bovetensis* Seguenza, but is obviously different from both.

Genus BULLINA Férussac, 1821.

Bullina Fer., Tab. Syst., p. xxx, 1821, proposed for *Bulla undulata* Brug., *physis, amplustre, scabra and velum* Dillw.—H. & A. Ad., Gen. Rec. Moll.. ii, p. 8.—A. Ad., in Sowb., Thesaurus Conch., ii, p. 563.—*Bullinula* (Beck) Swains., Malacol. p. 360, type *B. lineata* Sow., Man. f. 253.—Gray, P. Z. S. 1847, p. 162.

Shell oval, generally rimate, with *short, projecting spire, sinistral apex*, and large, swollen body-whorl; rather thin, *spirally punctate-grooved*, decorated with red or brown lines. Aperture about three-fourths the shells' length, narrow above, widened below; the columella vertical, often with an indistinct fold above, *obliquely truncated at base*. Operculum small, horny, linear, transverse. Type *B. scabra*.

This genus differs from other *Actæonidæ* in the style of coloring, the rather large distorted apex, and the very distinct basal truncation of the columella, more marked than in *Rictaxis*.

In Férussac's publication of the name *Bullina*, no diagnosis is given, and his list of species includes representatives of four genera. The first species named, "*Bulla undulata* Brug." (evidently an error for *B. undata* Brug.), cannot be considered the type because Bruguiere described no species under that name, and Férussac did not even have the true *undata* Brug. in mind, his "undulata" being probably an Oriental species. It would hardly be allowable to follow a type through paths so devious, especially when the identification rests upon the correction of two errors in Férussac's work, on purely hypothetical grounds: first, that by "*undulata* Brug.," Férussac meant "*undata* Brug.;" and second, that by this name he intended to indicate the species brought from Guam by Freycinet, and subsequently described by Quoy as *Bullæa guamense*. This inference is based upon Férussac's words, "deux tentacules distincts," his information being probably obtained from Freycinet's specimens. It seems to me that we can hardly agree with Martens that *B. guamensis*, or with Fischer that *B. undata* is the type of *Bullina;* too many guesses being involved in either case. Férussac included also in *Bullina*, "*B. amplustre*," the type of the prior genus

Aplustrum Schum.; *B. physis* and *velum*, belonging to *Hydatina* Schum.; and *B. scabra*, which H. & A. Adams and others have considered the type of the genus.

The few species are Indo-Pacific in distribution.

Key to Species.

a. Shell with spiral and longitudinal lines or bands of red.
  b. Spiral bands wide, *B. bruguieri.*
  bb. Spiral lines narrow, *B. scabra.*
aa. Shell translucent, with or without two spiral brown lines.
  b. Columella obliquely truncated below, *B. vitrea.*
  bb. Columella not truncated at base, *B. deshayesii.*

B. SCABRA Gmelin. Pl. 45, figs. 18–22.

Shell ovate, obese, rimate or perforate; white or faint roseate with two distant red spiral lines, and numerous arcuate or zig-zag longitudinal red lines. Spire very short; whorls about four, the nuclear whorl large, polished, reversed and distorted; the following whorls closely spirally grooved, the grooves formed of confluent oblong punctures; interspaces flat above, becoming narrower and rounded on the base. Aperture large, narrow behind; outer lip arched forward; columella vertical, straight, showing a very slight fold above, and obliquely truncated at base; the free edge of the columella recurved over the more or less open umbilical chink.

Alt. 12, diam. 7·7 mill. (Port Stephens, N. S. Wales).

Alt. 14, diam. 9 mill. (Nemoto, Boshiu, Japan).

Java (Chemnitz); *Mauritius*, *Polynesia* (Martens); *Port Elizabeth* (Sowb.); *Coogee Bay, Port Stephens, Middle Harbor, Lake Macquarie, Port Jackson, N. S. Wales, Australia* (Brazier, Angas. Cox *et al.*); *Hauraki Gulf, New Zealand* (Hutton); *Sandwich Islands* (Pse.); *Nemoto, Boshiu, Japan* (F. Stearns).

Bulla scabra, etc., CHEMNITZ, Conchyl. Cab. x, p. 118, pl. 146, f. 1352, 1353; GMELIN, Syst. Nat. (13), p. 3434, and of DILLWYN Catal., i, p. 484. LAMARCK, and other authors.—*Bullina scabra* AD., Thes. Conch., ii, p. 563, pl. 120, f. 1.—SOWB., Conch. Icon., xviii, f. 1.—MARTENS, Moll. Mauritius, p. 303.—DKR., Ind. Moll. Mar. Jap. p. 163.—*Aplustrum scabrum* WATSON, Chall. Rep. Gastr., p. 633. *Voluta ziczac* MUHLF., Ges. Naturforsch. Freunde zu Berlin, Mag. für die neuesten Entdeck., etc., viii, 1818, p. 5, pl. 1, f. 4. *Conf.* MKE., Mal. Bl., i, p. 40.—*Tornatella ziczac* MARTENS &

LANGKAVEL, Donum Bismarckianum, eine Samml. Südsee-Conchyl., p. 51, pl. 2, f. 20, 1871.—*Bulla lineata* GRAY, Ann. Philos. (N. S.) ix, p. 408, 1825.—WOOD, Index Test. Suppl., p. 9, no. 1, pl. 3, f. 1.—*Bullina lineata* A. AD., Thes. Conch., ii, p. 563, pl. 120, f. 2.—SOWB., Conch. Icon., xviii, pl. 1, f. 2.—BRAZIER, Proc. Linn. Soc. N. S. Wales, x, p. 92, 1885.—HUTTON, Man. N. Z. Moll., p. 120, 1880.—ANGAS, P. Z. S., 1867, p. 225.—*Bullina undata* H. & A. AD., Gen. Rec. Moll., ii, p. 8; iii, pl. 56, f. 5a, not *Bulla undata* Brug.—*Bullina lauta* PEASE, P. Z. S., 1860, p. 19.—SOWB., in Conch. Icon., xviii, f. 5.

In the series of specimens before me from New South Wales (Cox), Sandwich Is. (Pease) and Japan (Stearns), I am unable to see differences of any specific value. The absolute size, the elevation of the spire, the prominence of the obsolete columellar folds and the width of the umbilical perforation vary somewhat, but in my opinion the supposed species *lineata*, *ziczac* and *lauta* are not distinct from the widely distributed Indo-Pacific *B. scabra*.

B. BRUGUIERI A. Adams. Pl. 45, figs. 23, 24.

Shell oval, ventricose, perforated. Pink, with two yellowish-white bands, crossed by longitudinal pink undulating lines; transversely ribbed, ribs flat, rough; interstices with elevated longitudinal lines. Spire prominent, apex obtuse. Whorls 3, rounded. Aperture narrowly ovate, anteriorly produced; outer lip acute, grooved internally; inner lip posteriorly thin, reflected, adnate, anteriorly twisted (*Ad.*).

Ceylon (Sibbald).

Bullina bruguieri AD., in Thes. Conch., ii, p. 563, pl. 120, f. 3 (1855 ?).—SOWB., in Conch. Icon., xviii, pl. 1, f. 3, 1870.

I have not seen this form, which seems to be distinguished from *B. scabra* by its longer spire and broad spiral bands.

B. VITREA Pease. Pl. 45, figs. 25, 26.

Shell ovate, thin, fragile, white, with or without one or two sets of two or three fine transverse black lines on body whorl, transversely finely grooved; interstices punctured; spire obtuse; apex acute; whorls four; aperture oval, dilated at the base; slight fold at the base of the columella (not imperforate, umbilicated). (*Pse.*).

Sandwich Is. (Pse.).

Bullina vitrea PSE., P. Z. S., 1860, p. 19.—SOWB., Conch. Icon., xviii, pl. 1, f. 4.

Of the two specimens (types) in the British Museum, one is without the bands. The columella is obliquely truncated. This species differs from the preceding in being very pellucid, in the gray, not red color of the spiral bands, and the absence of longitudinal wavy lines.

B. DESHAYESII Pilsbry. Pl. 45, figs. 27, 28.

Shell ovate-turgid, thin pellucid; apex obtuse, white; encircled by two narrow, distant black lines. Spire short, obtuse. Whorls 5, narrow, convex, separated by a subcanaliculate depressed suture; last whorl large, obtuse with base transversely delicately sulcate. Aperture ovate-elongate, narrow and subemarginate behind, columella cylindrical, narrow, straight. Alt. 15, diam. 10 mill. (*Dh.*).

Island of Réunion (Dh.).

Bulla vitrea Pease, DESHAYES, Moll. Réun., p. 56, pl. 8, f. 2, 3.—*Bullina vitrea* MARTENS in Möbius' Reise n. Mauritius, p. 304.

This species differs from *B. vitrea* Pse. in the non-truncated columella and more obese form. The shell is thin, semi-transparent, milk-white, with two lines of intense black-brown. The suture is deep and somewhat channelled; last whorl five-sixths the entire length of the shell. Entire surface sculptured with fine, equal, shallow spiral grooves, in the bottoms of which a lens shows a regular punctation like that of *Actæon*. The outer lip is arched forward, forming a sort of shallow sinus behind.

Genus OVULACTÆON Dall, 1889.

Ovulactæon DALL, Blake Gastropoda, Bull. M. C. Z., xviii, p. 42.

Shell cypræiform, involute, with an apical perforation, as in *Bulla*; columella simple, without plaits; margin of the aperture continuous, simple, thickened, the callus on the body elevated, parallel with the outer lip; aperture narrow, almost linear, slightly effuse at the extremities, as long as the shell. Type *O. Meekii* Dall.

This interesting form resembles an involute *Globiconcha* with perforate apex and thickened aperture, or a rounded *Actæonella* without plaits. In the unplicate series of the *Actæonidæ* it holds a place analogous to that of *Cyprœactæon* White among the plicate forms. (*Dall*).

O. MEEKII Dall. Pl. 49, figs. 20, 21.

Shell with the outline of a small *Cyprœa*, like *C. edentula*, widest in its posterior third, white, polished with fine, distinct, im-

pressed incremental lines, and the faintest trace of spiral linear markings; a depressed line or sulcus indicates a previous resting stage half a whorl behind the present thickened aperture in the older specimens; in the younger, the varical sulcus is three quarters of a whorl behind the aperture. The apex in the older shell is perforate, the whole rounding over the perforation, and the spire invisible; in the younger specimen the perforation is proportionally wider, and about half a turn can be seen. The lines of growth become stronger and more regularly grooved as they pass over the summit into the pit. The aperture is very narrow, curved with the profile of the shell, and extending beyond the summit. Unlike *Cyprœa*, the thickening of the outer lip is altogether internal, simple, and smooth, the callus opposite is narrow, with a sharply-defined abrupt outer margin, and the inner margin raised sharply up parallel with the outer lip, with which it is continuous at the extremities: the flat part of the callus is widest anteriorly, polished but not smooth, but the raised edge is without teeth or transverse striation of any sort. The extremities of the aperture are elevated to follow the profile of the body of the shell. Lon. of largest specimen, 5·5; max. lat. 3·0 mill. (*Dall.*).

Off Havana (Sigsbee) in 450 fms; *West of North Bemini, Bahamas*, in 200 fms., sand (Dr. Rush).

O. meekii Dall, *l. c.*, p. 43, pl. 33, f. 3, 4.

This extremely interesting shell is well shown by the figure. There can be little question as to its probable relations. The characters of the aperture are essentially different from anything among the *Cyprœidæ*, and it has not the polished laquer which species of that family owe to the expanded mantle-margin. Only one specimen was obtained at either locality (*Dall*).

Genus KLEINELLA A. Adams, 1860.

Kleinella Ad., Ann. and Mag. Nat. Hist. (3), v, p. 302, April, 1860, type *K. cancellaris*.

Shell ovate, thin, umbilicate, with cancellated surface; spire produced, the apex obtuse; aperture elongated, anteriorly produced and entire; inner lip thin, simple; outer lip angled behind, straight in the middle, margin acute.

This genus most nearly resembles *Actæon*, but is without any fold on the columella; the umbilicus moreover is wide and deep, and the surface of the shell is cancellated. The outer lip forms an angle

posteriorly with the last whorl, and is straight in the middle (*Ad.*).

This is a group of entirely problematic affinities, but, in my opinion, it does not belong to the *Actæonidæ*. The species are here described because precedent has established this position for the group.

K. CANCELLARIS A. Adams.

Shell oblong, widely and profoundly umbilicated; spire rather raised, the apex obtuse; pale brown; whorls 3½, slightly convex (the last ventricose), regularly cancellated. Aperture oval; inner lip thin, simple; outer lip straight in the middle, angulated behind. Length 3⅛ mill. (*Ad.*).

Strait of Corea, 63 fms. (Ad.).

Kleinella cancellaris AD., Ann. Mag. (3), v, p. 302.

K. SULCATA A. Adams.

Shell oblong, thin, turbinate, deeply umbilicated; spire elevated, conoid; dull white; transversely sulcate, the sulci distant, interstices longitudinally closely striated; whorls 3½, flat, angulated above; last whorl ventricose. Aperture oblong, anteriorly everted and subeffuse; lip thin, angulated behind (*Ad.*).

Suwonado Sea, Japan, 7 fms. (*Ad.*).

Kleinella sulcata A. AD., Ann. Mag. Nat. Hist. (3), ix, p. 295, April, 1862.

Family TORNATINIDÆ Fischer.

Shell spiral, cylindrical or fusiform, external, capable of containing the soft parts; spire short or sunken and concealed, the apex more or less turned over; aperture long and narrow, wider below; columella with a fold or simple; umbilicus none or very narrow. Animal with the foot shorter than the shell, entire behind; head-shield short, quadrangular, produced in two erected processes behind, near the bases of which are the eyes. Radula-teeth wanting; gizzard armed with three oval, tuberculate plates (See pl. 60).

These snails differ from *Scaphandridæ* in the shorter differently shaped head-shield, the lack of epipodial (lateral) lobes and radula; the differently shaped gizzard-plates, etc. They are unlike *Actæonidæ* in wanting operculum and radula.

Although the characters of the animal are so obvious and distinctive, it is by no means easy to classify many species known by the shell alone, certain forms referred to *Retusa* being excessively similar in

shell characters to the *Cylichna* group of *Scaphandridæ*. It is therefore very important to observe the soft parts when they can be obtained, for it is only by such patient observation by local naturalists that these interesting little snails can be understood and rightly classified. In *Tornatinidæ* some whole genera and subgenera, such as *Tornatina* and *Sao*, are still known only by the shells; and many species of the other groups are doubtless incorrectly placed at present.

Synopsis of Genera.

Genus TORNATINA A. Ad.

Shell cylindrical, with conic or flattened spire, the apex projecting and mamillar, sinistral, tilted at an angle with the body-whorl; suture channelled. Columella with one fold.

Genus RETUSA Brown.

Shell cylindrical, the spire slightly convex, flat or concave, apex intorted; suture not distinctly channelled. Columella with one fold or none.

Section *Cylichnina* Monts. Shell *Cylichna*-shaped, with the summit perforated in the centre, spire sunken. Type *B. umbilicata* Mont.

Section *Pyrunculus* Pils. Shell pear-shaped, wide below, narrow above; spire as in *Cylichnina*. Type *C. pyriformis*.

Genus VOLVULA A. Adams.

Shell fusiform, the last whorl forming a projecting process above the spire, apical perforation narrow or closed; aperture as long as the shell, narrow; columella with no distinct fold.

Genus TORNATINA A. Adams, 1850.

Tornatina Ad., Thes. Conch., ii, p. 554.—Fischer, Manuel, p. 555.

Shell cylindrical or oblong with conical or flattened spire, *the apex projecting and mamillar, sinistral, tilted so that its axis lies at an angle* of about 90° with that of the shell. *Suture channelled.* Aperture long, narrow above, dilated and rounded below, the outer lip arched forward, retreating at suture and base; columella arcuate, calloused, *with one spiral fold* at its junction with the whorl. Type *T. voluta* Q. & G.

Animal externally as in *Retusa* (pl. 60, f. 18, *T. voluta*.)

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Tornatina differs from *Retusa* in the conspicuously channelled suture and the peculiar, projecting apex; but it has been united with that group by some authors, and until the soft parts are known, the exact status of the group is a mere matter of opinion. We prefer not to assume, with Fischer, that in anatomy it is like "*Coleophysis*," although that is not in the least improbable; for that assumption would force us to disturb the received nomenclature to a radical degree; and it is always better to continue to use well known generic names until the necessary changes can be placed upon a sound basis. At present, the dentition of *Tornatina* is absolutely unknown; and as that name has become well established in conchological nomenclature, I consider that no good end would be reached by reducing it to a subgenus of *Retusa*—a course inevitable if Fischer's ideas are followed to their logical conclusions.

This genus consists of small and minute shells, white or light brown in color, with peculiarly projecting, teat-like, uptilted, nuclear shell and one small columellar fold. The distribution of the group is practically world wide. They live at moderate or considerable depths, and probably subsist mainly upon Foraminifera. The species are numerous, but not especially difficult to distinguish if properly described and figured; but, unfortunately, a considerable number of A. Adams' forms are known by poor, small figures only, with insufficient descriptions; so that until these are refigured from the types, their identification will not be easy.

Species of the Azores and West Africa.

T. PROTRACTA Dautzenberg. Pl. 25, figs. 39, 40, 41.

Shell 1·5 mill. high, ·75 mill. wide, ovate-cylindrical, convoluted, very shining; first whorl intorted, very much projecting; last whorl rather flattened below the suture, then becoming rather convex. Surface smooth, with very fine growth-lines only. Aperture elongated, contracted above, dilated toward the base; columella simple, arcuate; lip sharp, subarcuate; color white, throughout (*Dautz*).

Pico, Azores, in 1287 meters.

Tornatina protracta DAUTZ., Rés. Campagnes Sci. Prince Albert I, p. 22, pl. 1, f. 4, 1889.

In its general form, as well as the conformation of the apex, this species approaches *T. leptekes* Wats., but it is smaller, less elongated, with fewer whorls.

T. KNOCKERI Smith. Pl. 22, fig. 28.

Shell cylindrical, whitish; spire turrited, very short; apex tubercular; whorls 5, the last polished, smooth, angular and plicate above. Aperture nearly as long as the last whorl; lip straight; columella uniplicate. Alt. 4·5, diam. 2 mill. (*Smith*).

Whydah, West Africa.

Tornatina knockeri SMITH, P. Z. S., 1871, p. 738, pl. 75. f. 30.—*Conf.* COOKE, Ann. Mag. N. H. (5), xvii, p. 129.

Easily known by its flattish spire, tubercular apex, and the plications at the upper part of the body-whorl (*Smith*).

This species is closely allied to the Red Sea forms *mucronata* Phil. and *issellii* Pils.

Species of the East Coast of America and the West Indies.

The forms found in this region all have a conspicuous, mamillar, upturned nucleus.

a. Surface spirally striated.

b. Large, alt. about 10 mill., *bullata.*

bb. Small, alt. about 2 mill., *recta.*

aa. Surface of body-whorl without spiral striæ, *canaliculata, candei, liratispira.*

T. BULLATA Kiener. Pl. 50, fig. 30; pl. 22, figs. 17–19.

Shell solid, ivory-white, cylindrical, a little constricted in the middle, having faint growth-striae and *very fine spiral wavy striæ* all over, but fainter on the shoulder. Spire conical, terraced, the apex minute, overturned, and projecting, mamillar. Suture deeply channelled, but whorls not concave above. Aperture long and narrow above, the outer lip inflexed somewhat, columella short, concave, with one stout fold. Alt. 11, diam. 5 mill.; alt. 9, diam. 3·8 mill.

Florida Keys, entire West Indies.

Tornatella bullata KIENER, Sp. et Icon., Coq. Viv., p. 5, pl. 1, f. 4. —*Tornatina bullata* MORCH, Mal. Bl., xxii, p. 171.—DALL Cat. Mar. Moll. S.-E. U. S. p. 84.—*Bulla canaliculata* ORB. (not Say), Moll. Cuba p. 133, pl. 4 bis, f. 21–24.—*Tornatina olivula* A. AD., Thes. Conch., ii, p. 569, pl. 121, f. 34.

This is the largest of the West Indian Tornatinas. It has the same general form of *T. canaliculata* and *T. candei*, but is distinguished by its close spiral striation. The synonymous *T. canaliculata* Orb. (not Say) is shown in pl. 22, f. 17–19; and *T. olivula* Ad., also a synonym, in pl. 25, f. 47.

T. RECTA Orbigny. Pl. 22, figs. 13, 14, 15.

Shell oblong, cylindrical, straight, thin, white, shining, delicately spirally substriate; spire short, the suture channelled. Aperture linear, straight above, suddenly dilated below, the columella with a slight fold. Alt. 2, diam. 1 mill.

Florida Keys; entire West Indies; *St. Helena.*

Bulla recta ORB., Moll. Cuba, i, p. 131, pl. 4 bis, f. 17–20.—*Tornatina recta* MORCH., Malak. Bl., xxii, p. 171.—DALL, Rep. Blake Gastr., p. 45; Cat. Mar. Moll. S.-E. U. S., p. 84.—SMITH, P. Z. S., 1890, p. 297.

Distinguished from *T. candei* by the weakness of the columellar fold and the spiral striation; from *bullata* by its small size.

T. CANALICULATA Say. Pl. 22, fig. 23; pl. 50, fig. 25, 26.

Shell small, cylindrical, with low, conoidal terraced spire and mamillar, strongly projecting minute apex. Ivory-white, with very delicate growth-lines but no other sculpture. Whorls separated by a channelled suture, concave-topped and more or less keeled at the shoulder; the last whorl cylindrical, tapering below. Aperture about eight-tenths the shell's length, narrow above, broadly rounded below, the outer lip thin, arched forward, retracted below; columella thickened, concave, with a strong spiral fold. Alt. 5·5, diam. 2·75 mill. (S. Carolina specimen). Alt. 4·2, diam. 2·1 mill. (Massachusetts specimen).

Cape Cod, Massachusetts, to Haiti, and Silam, Yucatan, 0 to 63 fms.

Volvaria canaliculata SAY, Journ. Acad. Nat. Sci., Phila., v, p. 211, 1822.—*Bullina canaliculata* SAY, Amer. Conch., pl. 19.—*Bulla canaliculata* GLD., Inv. Mass., p. 166, f. 97.—*Utriculus canaliculatus* STIMP., Check-lists, 4.—BINNEY-GOULD, Invert. Mass., p. 219, f. 510.—WATSON, Chall. Rep. Gastr., p. 655.—*Tornatina canaliculata* AD., Thes. Conch., ii, p. 566, pl. 121. f. 25.—DALL, Blake Gastr., p. 45; Cat. Mar. Moll. S.-E. U. S., p. 84.—*Bulla obstricta* GLD., Silliman's Journ. Sci., xxxviii, p. 196, 1840; Invert. Mass., p. 167, f. 96.—*Tornatina obstricta* AD., Thes., ii, p. 566, t. 121, f. 29.

This is a larger species than the West Indian *T. candei*, with smaller nuclear shell. Plate 50, figs. 25, 26, represent New Bedford specimens. Fig. 23 of pl. 22 was drawn from a Massachusetts specimen which had lost its apex, a common mutilation, even in living shells. The apex is uptilted at an angle of 90°, as in *T. candei*, etc., but it is much smaller than in that species, although the shell is

larger. Fig. 24, of plate 22, represents *B. obstricta* Gould, which seems to have no distinctive characters.

T. CANDEI Orbigny. Pl. 22, figs. 21, 22; pl. 50, figs. 27, 28, 29.

Shell small, cylindrical, tapering below, milk-white, rather solid but thin; spire conical, terraced, the apex large and projecting. Surface shining, smooth, except for faint growth-lines; whorls of spire concave or channelled above. Aperture long and narrow; uter lip strongly arched forward, retracted at base; columella short, concave, with a moderately strong fold.

Alt. 2·6, diam. 1·3 mill.

Alt. 3, diam. 1·4 mill.

Alt. 4, diam, 1·8 mill.

Off Hatteras; West Florida and Fla. Keys, South to Martinique, 0–48 fms.

Bulla candei ORB., Moll. Cuba, *i*, p. 128, pl. 4, f. 1–4.—*Tornatina candei* VERRILL, Trans. Conn. Acad., vi, p. 468, pl. 45, f. 13.—DALL, Blake Rep., 45; Cat. Mar. Moll., S.-E. U. S., p. 84.

This species is constantly much smaller than *T. canaliculata*, with larger apex and more strongly curved outer lip. The spire varies in height, being often somewhat scalar. Mörch sees this species in *Bulla pusilla* Pfr., but the description of that form is hardly sufficient for positive identification.

T. PUSILLA Pfeiffer.

Shell oblong, solid, shining white; spire short, the apex mamillate; whorls 2, the last four times as long as the spire; columella uniplicate at base; outer lip arcuate in the middle; aperture narrowed above. Alt. 2, diam. $\frac{4}{5}$ lines (*Pfr.*).

Cuba (*Pfr.*).

Bulla pusilla PFR., Arch. f. Naturg., 1840, p. 250.—MORCH, Mal. Bl., xxii, p. 171.

Probably identical with *T. candei* Orb. The *T. pusilla* of A. Ad. (Thes. p. 568) seems to be something different. It is said to have a rather wide umbilical fissure.

T. LIRATISPIRA Smith. *Unfigured.*

Shell cylindrical, a little wider above than at base, white, shining, striated with curved growth-lines. Whorls 5, acutely margined above, the first tubercular; spire very short, turrited; suture widely channelled, divided by a hair-like thread in the middle; aperture

narrow, dilated at base; columella spirally one-folded. Alt. 6, diam. 3 mill. (*Sm.*).

Rio Janeiro.

T. liratispira E. A. Smith, Ann. Mag. N. H. (4), ix, p. 354.

This species is allied to *T. knockeri* from West Africa, but it may be known from it by its larger size, and the absence of the plications at the upper part of the body whorl; the columellar fold also is less strongly developed. The very fine ridge in the middle of the sutural channel produces the appearance of a double edge to the whorls (*Sm.*).

Some specimens of *T. canaliculata* show a spiral thread in the sutural channel.

Species of the Californian and Panamic Provinces.

a. Shell without spiral striæ or color lines.

b. Upper part of body-whorl vertically ribbed, *harpa.*

bb. Entire shell smooth except for growth-striæ, *cerealis, inculta, infrequens, carinata.*

aa. Shell large, solid, brown, with spiral striæ, *culcitella.*

T. harpa Dall. Pl. 22, fig. 16.

Shell small white of four and a half whorls; tabulate and sharply carinate above, characterized by sharp grooves and raised lines parallel with the lines of growth, which extend half over the whorls and become obsolete anteriorly; apex mammillated, minute, globular, prominent, suture canaliculated. Anterior portion of the last whorl smooth. Last whorl slightly narrower above. Aperture long, narrow, effuse below, with a deep narrow sinus at the suture. Columella thickened with a thin layer of white callus, columellar plait obsolete in the adult, rather prominent in young shells. Carina intersected by the grooves and slightly dentate.

Alt. ·24, diam. ·12 inch. (*Dall*).

Monterey, California; adhering to the tentaculæ of Actinias; three specimens.

Tornatina harpa Dall, Amer. Journ. Conch. vii, p. 136, pl. 15, f. 11 (Nov. 2, 1871).

This pretty and very distinct species is unlike any other from the coast, and is readily recognized by the characteristic grooves. (*Dall*).

T. INFREQUENS C. B. Adams. *Unfigured.*

Shell cylindric, not compressed about the middle; white; smooth; apex papillary, very minute and prominent; spire moderately elevated, convex; whorls four and one-half, acutely shouldered, with a deeply channelled suture; aperture long and narrow, anteriorly rounded; labrum very thin, much advanced along the middle; columella terminating in a very robust spiral plait. Mean divergence about 130°; length ·28 inch; breadth ·11 inch; length of spire ·03 inch. (*Ad.*).

Alt. ·14, alt. of spire ·03, diam. ·05 inch. (*Cpr.*).

Panama (C. B. Ad., 2 specimens); *Mazatlan*, very rare, on *Spondylus calcifer*. (Cpr.).

Bulla (*Tornatina*) *infrequens* C. B. AD., Panama Shells, p. 214, 319.—*Tornatina infrequens* CPR., Maz. Cat., p. 171.—? *Bulla* (*Torntina*) *gracilis* MKE., Zeitschr. f. Mal. 1850, p. 162, not of A. Adams.

Menke's species being white, not horn-coloured like *T. gracilis* from the China Seas, and being identified from a single specimen wedged in the mouth of a dead Conus puncticulatus, is almost certainly the same as that described by C. B. Ad. from Panama. *T. infrequens* is distinguished by the olive-like spire, more or less elevated and deeply channeled along the suture. The body whorl is not swollen anteriorly, and the fold lies slanting on its base. (*Cpr.*).

T. CARINATA Carpenter. *Unfigured.*

Shell cylindrical, white, smooth, acutely carinated below the appressed suture, between the suture and the carina excavated. Whorls 5, the two earlier being discoidal and affixed vertically upon the spire, which is more or less apparent. Aperture elongate, the lip acute and produced in the middle, slightly sinused behind; inner lip thin, swollen above the junction with the columella proper. Columella provided with a stout spiral fold where it joins the parietal wall. (*Cpr.*).

Alt. ·037 (smallest specimen).

Alt. ·11, diam. ·05 inch.; length of spire ·02 inch.

Mazatlan, on Chama and *Spondylus*, very rare (Liverpool Colln.); *San Diego, California.*

Tornatina carinata CPR., Maz. Cat., p. 171.—Rep. Brit. Asso. Adv. Sci. 1856, pp. 250, 313; Moll. Western America, Smiths. Misc. Coll. no. 252, pp. 37, 97, 133, 194.

Known from *T. infrequens* (1) by the smaller size, and more irregular spire; (2) by the suture, which is not channeled; (3) by the shoulder, which is sharply carinated, with the space hollowed between the keel and suture; (4) by the swelling of the body-whorl at the base; and (5) by the plait which runs more transversely, below the body whorl, instead of obliquely, almost on it, as in *T. infrequens*. By some of the above characters it is further distinguished from *T. cerealis* Gld. which resembles *T. infrequens* much more closely than this species. All the three forms begin life as a small discoidal body, like a tumid Planorbis. After making about two turns of this, they proceed in the regular way affixing the disk vertically, or sometimes in a slanting direction at the top of the spire. The length of spire in this species, which is not so rare as *T. infrequens*, is extremely variable. (*Cpr.*).

T. INCULTA Gould. Pl. 59, fig. 15.

Shell minute, ivory-white, rather solid, elongate-oval, longitudinally most minutely striated; spire elevated; whorls 4, squarely terraced; aperture about seven-eights the length of the shell, dilated below; outer lip inflexed, rounded behind; columella arcuate, calloused, with one fold. The spire is sometimes scarcely exserted. (*Gld. & Cpr.*).

Alt. 5·5, diam. 2·5 mill.

San Diego (Gld.); *Monterey* (Gabb), *California*.

Tornatina inculta Gld., GLD. & CPR., P. Z. S. 1856, p. 203.—CPR. Brit. Asso. Adv. Sci. 1856, pp. 227, 313, 351; Moll. Western N. A. p. 79.

My figure is drawn from a beach-worn specimen collected by Gabb. The upper half of the body-whorl is rather contracted, the lower half swollen, and the sutures are rather deeply channelled.

T. CEREALIS Gould. Pl. 50, figs. 39, 40.

Shell cylindrical, with very short spire, light brown. Surface smooth except for curved growth-striæ. Aperture long, narrow, somewhat widened below, the outer lip arched forward; columella rather straight, oblique, with a spiral fold.

Alt. 4, diam. 1·9 mill.

San Diego, California to Vancouver Island.

Bulla (*Tornatina*) *cerealis* GLD., Bost. Journ. N. H. vi, 1852, p. 375; Otia p. 184.—GLD. & CPR., P. Z. S. 1856, p. 203.—CPR., Rep.

Brit. Asso. 1856, pp. 227, 313, 349; Moll. W. N. A., Smith. Misc. Coll. 252, p. 23, 133.

The height of the spire varies, being sometimes nearly flat, sometimes low-conoidal; the uptilted nucleus projecting. In all adult specimens I have seen, the nucleus has been lost by erosion, as in the figures.

T. CULCITELLA Gould. Pl. 50, fig. 38.

Shell cylindrical-fusiform, with elevated, conical spire; solid; white under a very thin buff cuticle, densely marked with close finely undulating, chestnut spiral lines. Whorls 5, separated by deep sutures, the apical whorl mamillar and uptilted. Aperture long and narrow above, about eight-tenths the entire length of the shell, dilated below, the outer lip arched forward, abruptly and deeply retracted above, effuse below. Columellar fold very strong.

Alt. 8·5, diam. 3·2 mill. (San Pedro specimen).

Alt. 1, diam. ¼ inch. (Gld.).

Santa Barbara (Jewett) *and San Pedro, California.*

Bulla (*Akera*) *culcitella* GLD., Bost. Journ. Nat. Hist. vi, p. 375, Apr., 1852; Otia, p. 184.—*Tornatina culcitella* GLD. & CPR., P. Z. S. 1856, p. 203.—CPR., Rep. Brit. Asso. Adv. Sci. 1856, pp. 313, 349; Moll. W. N. A., Smiths. Misc. Coll. 252, p. 23, 133.—KEEP, West Coast Shells, p. 125. f. 114.

The close spiral brown striæ are characteristic, as well as the conically elevated spire.

T. EXIMIA Baird. *Unfigured.*

Shell cylindrical, greenish-buff, striated, the striæ minute, close, undulating; spire very short and concavely excavated. Aperture long, effuse at base; lip acute, columella abruptly arcuate at base. Alt. 12·5 mill. (*Bd.*).

Esquimalt Harbor, Vancouver's Island.

Bullina (*Tornatina*) *eximia* BD., P. Z. S. 1863, p. 67, and in Lord's The Naturalist in Vancouver Isl. and Brit. Columbia, ii, p. 361, 1866.—*Tornatina eximia* Bd., CPR., Moll. Western N. A., pp. 89, 90, 133.

Indo-Pacific and Australian species.

T. SANDWICENSIS Pease. *Unfigured.*

Shell small, cylindrical, shining, white, finely striated transversely; spire elevated; whorls 4; aperture contracted posteriorly, dilated anteriorly; slight fold on columella. (*Pse.*).

Sandwich Is. (Pease).

T. sandwicensis PSE., P. Z. S. 1860, p. 19.

T. EXILIS Dunker. Pl. 22, fig. 25.

Shell white, thin, subdiaphanous, ovate-oblong, very delicately longitudinally striated; spire conical, channelled and mucronate. Aperture narrow above, dilated toward the base; columella with an obsolete fold. Alt. 4½, diam. 2 mill. (*Dkr.*).

Japan.

Bulla exilis DKR., Malak. Bl. vi, p. 222; Moll. Jap., p. 25, pl. 2, f. 14; Index, p. 164.—LISCHKE, Jap. Meeres-Conch., p. 105.

T. DELICATULA A. Adams. *Unfigured.*

Shell cylindric-ovate, white, thin, shining, the spire truncated, apex mammillate; longitudinally substriate, aperture linear, dilated below, the inner lip with a conspicuous oblique fold; lip margin slightly arcuate. (*Ad.*).

Mino-Sima, Japan, 63 fms. (Ad.).

T. delicatula AD., Ann. Mag. N. H. (3), ix, p. 153.

In the obtuse, subtruncate spire and the papillary apex this species resembles *T. pusilla* Pfr.; but it is longer and more slender, and the aperture is more produced anteriorly. (*Ad.*).

T. PERSIANA Smith. *Unfigured.*

Shell very minute, short cylindrical, white, roughened by curved lines of growth; whorls 3, the first consisting of a large tubercle, the rest encircled above by a large rounded cord; suture depressed. Aperture rather wide, shorter than the last whorls, sensibly dilated at base; columella short, thickened, hardly twisted. Alt. 1·33, diam. ·75 mill. (*Sm.*).

Persian Gulf, 14 fms. (Col. Pelly).

T. persiana SM., Ann. Mag. N. H. (4), ix, p. 354 (May, 1872).

Its minuteness constitutes the principal distinctive character of this species. The tubercle which forms the apex is proportionately very large. (*Sm.*).

T. ISSELII Pilsbry. Pl. 22, fig. 33.

Shell minute, cylindrical, smooth, translucid, whitish; apex mucronate; spire nearly flat; whorls 3, separated by a distinct suture, the first extremely narrow, the last long, a trifle tapering at the base. Aperture linear, wider below, rounded; right margin simple nearly straight; columella short, intorted.

Alt. 2·25, diam. 1·2 mill. (*Issel*).

Harbor of Suez.

Tornatina pusilla ISSEL, Mal. Mar Rosso, p. 172, pl. 1, f. 15, 1869. Not *T. pusilla* Pfr., or of A. Ad.

T. MUCRONATA Philippi. *Unfigured.*

Shell minute, oblong, linear, smooth, surface obsoletely longitudinally striated; spire retuse, produced in a mucro in the middle; whorls 4, deeply plicated at the suture, subcoronated. Aperture narrowly linear above, dilated below, uniplicate; lip straight, a little reflexed in the middle. Alt. 1¼ lines. (*Ph.*).

Aden (Phil.).

Bulla mucronata PHIL., Malak. Bl. 1849, p. 22.—*Tornatina mucronata* Phil., ISSEL, Mal. Mar Rosso, p. 172.

This is perhaps the species referred to by Mr. A. H. Cooke as near to *T. knockeri* Smith. It evidently belongs to the group of *knockeri* and *isselii*.

T. OLIVÆFORMIS Issel. Pl. 22, fig. 34.

Shell minute, thin, cylindrical-oblong, whitish, smooth, shining, slightly subdiaphanous; the apex a little acute, sinistral; spire conic; whorls 4, separated by a channelled suture, the first narrow, flat, the last large, subcylindrical, over three-fourths the altitude, attenuated at base. Aperture elongated, narrow above, dilated below androun ded; right margin little arcuate, produced, acute; columella white, callous, at the base uniplicate and a little reflexed. Alt. 4, diam. 1·5 mill. (*Issel*).

Gulf of Suez.

SAVIGNY, Descript. de l'Egypte, Coq.; pl. 6, f. 25.—*Tornatina olivæformis* ISSEL, Mal. Mar Rosso, p. 171, 1869.—COOKE, Ann. Mag. N. H. (5), xvii, p. 129.

Cooke finds no difference between this and *T. fusiformis* A. Ad., and considers them synonymous, the latter name having priority.

T. PLANOSPIRA A. Adams. Pl. 25, fig. 45.

Shell cylindrical, apex truncated (in the very poor type specimen), white, smooth, subpellucid, longitudinally grooved; spire depressed, level-topped; whorls 4, grooved, radiately striated; aperture narrow, anteriorly dilated; columella callous, with a single plait. (*Ad.*).

Sorsagon, Luzon, Philippines, 4 fms. (Cuming); *Red Sea* (Cooke)

Tornatina planospira AD. Thes. Conch. ii, p. 568, pl. 121, f. 32; Ann. Mag. (3), ix, p. 153.—COOKE, Ann. Mag. N. H. (5), xvii, p. 130.

T. INCONSPICUA H. Adams. Pl. 22, fig. 26.

Shell elongate-ovoid, rather solid, delicately transversely striated anteriorly, whitish; spire little exserted. Aperture narrow, coarctate in the middle, dilated below; columella furnished with a minute fold; lip margin arcuate. Alt. 3, diam. 1·5 mill. (*H. Ad.*).

Red Sea.

T. inconspicua H. AD., P. Z. S. 1872, p. 11, pl. 3, f. 12.—*Conf.* COOKE, Ann. Mag. N. H. (5), xvii, p. 130.

Mr. A. H. Cooke considers this very close to, or synonymous with, *T. planospira*. The "antice transversim tenuissime striata" of H. Adams' description seems, however, to be a distinguishing character.

T. BIPLEX A. Adams. Pl. 25, fig. 46.

Shell cylindrical, apex subtruncated, white, solid, shining transversely striated; spire depressed, whorls four; aperture linear, contracted in the middle, anteriorly dilated; outer lip posteriorly produced, a little receding, reflexed in the middle, anteriorly with a single strong tubercle; columella with a single plait. (*Ad.*).

China Sea (Cuming).

T. biplex A. AD., Thes. Conch. ii, p. 568, pl. 121, f. 33.—BRAZIER, Proc. Linn. Soc. N. S. Wales, ii, p. 82.

Brazier reports this from Torres Strait.

T. POLITA A. Adams. Pl. 25, fig. 52.

Shell ovately cylindrical, rounded above; apex truncated, white, solid, shining, inferiorly transversely striated; spire depressed,

whorls three, rounded smooth; aperture narrow, posteriorly produced, rather contracted in the middle, dilated anteriorly, outer lip rather bent in and thickened in the middle; columella with the fold very distinct. (*Ad.*).

Bay of Manilla, 3 fms. (Cuming).

T. polita A. Ad., Thes., p. 571, pl. 121, f. 39.

T. SIMPLEX A. Adams. Pl. 25, fig. 51.

Shell ovately cylindrical, white shining, polished, smooth, covered with a fuscous epidermis; spire elevated, whorls five, the first one mammillated; spiral lamina conspicuous; aperture narrow, dilated anteriorly; columella slightly callous, plait obsolete. (*Ad.*).

Cagayan, Mindanao, Philippines, 35 fms. (Cuming); *Japan* (A. Ad.).

T. simplex AD., Thes. Conch. ii, p. 570, pl. 121, f. 38; Ann. Mag. N. H. (3), ix, p. 153.

T. CINCTELLA A. Adams. Pl. 25, fig. 48.

Shell cylindrically fusiform, apex acuminated, rather smooth, semipellucid, longitudinally sulcated, encircled with two white spiral bands; spire acuminated, whorls four, the first prominent; aperture narrow, anteriorly dilated; columella with a very distinct plait; umbilical fissure deep. (*Ad.*).

China Sea (Cuming).

T. cinctella A. AD., Thes. Conch. ii, p. 569, pl. 121, f. 35.

The two white bands on a pellucid ground, and the umbilical fissure distinguish this species.

T. COARCTATA A. Adams. Pl. 25, fig. 44.

Shell ovately cylindrical, somewhat narrowed in the middle, white, shining, engraved with very fine close spiral lines; spire somewhat depressed, whorls four, suture deeply channelled, encircled with a spiral lamina from the columellar callus; aperture narrow, contracted in the middle, inferiorly dilated; columellar callus with an obsolete fold; outer lip rounded above, subinflexed in the middle. (*Ad.*).

Ticao, Philippines, in 6 fms. (Cuming); *Mauritius* (Martens).

T. coarctata AD., Thes. Conch. ii, p. 568, pl. 121, f. 31.—MARTENS in Möbius' Reise nach Mauritius, p. 303.

T. GRACILIS A. Adams. Pl. 25, fig. 49.

Shell cylindrically fusiform, slender, semipellucid, horn-colored, apex acuminated, transversely engraved with a very fine spiral striæ; spire produced, pointed, whorls four, the first prominent; aperture narrow, dilated anteriorly; columella with a single plait. (*Ad.*).

China Sea (Cuming); *Japan* (A. AD.); *Torres Strait* (Brazier).

T. gracilis A. AD., Thes. Conch. ii, p. 569, pl. 121, f. 36; Ann. Mag. N. H. (3), ix, p. 153.—BRAZ. P. L. S., N. S. W. ii, p. 82.

This differs from *T. singaporensis* in possessing minute spiral striæ.

T. SINGAPORENSIS Pilsbry, n. sp. Pl. 50, figs. 31, 32, 33, 34.

Shell white, slender, elongated-subcylindrical, with elevated spire and very large mamillar apex; post-apical whorls nearly four, slightly convex, separated by narrowly, deeply channelled sutures; last whorl tapering above and below, smooth except for delicate, curved growth-striæ. Aperture narrow and long, two-thirds the entire length of shell; columella calloused, with an extremely weak fold, and a slight groove in the umbilical region.

Alt. 3·2, diam. 1·35 mill.

Singapore (Dr. S. Archer!).

This tiny species has an unusually long spire, with very large apical button. The surface entirely lacks spiral striæ, and the columellar fold (fig. 31) is unusually weak. In the type specimen the spire of the apical whorl is directed away from the face of the shell. Fig. 32 represents a front view of the spire, showing the umbilical aspect of the uptilted apex; fig. 33 represents a back view of the spire, showing the apical aspect of the nuclear shell. The figures being camera lucida sketches, may be depended upon for accuracy of outline and proportion, qualities unfortunately lacking in many of the figures of Sowerby's Thesaurus.

T. FUSIFORMIS A. Adams. Pl. 22, fig. 27.

Shell cylindrically fusiform, white, smooth, semipellucid, longitudinally somewhat sulcated; spire elevated, acuminate; whorls 5, somewhat channelled above. Aperture linear, contracted in the

middle, dilated anteriorly; columella slightly plicated, plait callous: outer lip inflexed in the middle. (*Ad.*).

China Sea (Cuming); *Japan* (A. Ad.); *Port Jackson* (Angas, Brazier), *and Torres Strait, N. Australia* (Brazier); *Gulf of Suez* (Cooke).

T. fusiformis Ad., Thes. Conch. ii, p. 570, pl. 121, f. 37; Ann. Mag. N. H. (3), ix, p. 153.—Angas, P. Z. S. 1867, p. 226.—Brazier, Proc. Linn. Soc. N. S. Wales, ii, p. 82.—Cooke, Ann. Mag. N. H. (5), xvii, p. 129.—Dkr., Index Moll. Mar. Jap., p. 165.

T. capitata Pilsbry, n. sp. Pl. 50, figs. 35, 36, 37.

Shell minute, white, smooth except for slight, curved growth-striæ; cylindrical, rather obese, with short spire and very large projecting nucleus. Post-apical whorls about 3, hardly convex, separated by deeply channelled sutures; last whorl obese-cylindrical. Aperture long and rather narrow, slightly more than three-fourths the length of the shell; columella calloused, having a weak fold and a slight umbilical groove.

Alt. 3, diam. 1·4 mill.

Singapore (S. Archer), 5 specimens.

The columella is shaped like that of *T. singaporensis*, but the spire is notably shorter, and the entire form more obese. This should be compared with *T. fusiformis* Ad., authentic specimens of which I have not seen. The uptilted apex is unusually large, and in the type specimen its spire is directed forward. Fig. 37, represents the spire viewed from the face of the shell; fig. 35, the spire viewed from behind, showing the umbilical aspect of the nucleus.

T. voluta Quoy & Gaimard. Pl. 22, figs. 29, 30, 31.

Shell cylindrical, elongated; smooth except for sharp, fine, remote spiral striations; white; spire produced, the apex acute; suture channelled, the top of the whorls excavated into another channel bounded by the upward continuation of the inner lip.

Alt. 10, diam. 4½ mill.

Guam (Q. & G.); *Torres Sts.* (Braz.); *Levuka, Fiji* (Challenger).

Bulla voluta Q. & G., Voy. Astrol. ii, p. 359, pl. 26, f. 33–35.—*Tornatina voluta* Adams, Thes. Conch. ii, p. 566, pl. 121, f. 24; Ann. Mag. Nat. Hist. (3), ix, p. 153.—Brazier, Proc. Linn. Soc. N. S. Wales, ii, p. 82.—E. A. Smith, Zool. Coll. Alert, p. 505.—Cooke, Ann. Mag. Nat. Hist. (5), xvii, p. 129.—*Utriculus* (*Tornatina*) *voluta* Watson, Chall. Rep. Gastr., p. 656.

Has been reported from Japan by A. Adams, and from the Gulf of Suez by Cooke.

T. LACTUCA G. & H. Nevill. Pl. 27, fig. 1.

Shell narrowly cylindrical, solid, smooth, shining, white; whorls 3, channelled at the suture; spire very short, a little exserted, the nucleus mamillate; last whorl a little constricted in the middle. Aperture narrow and linear above, incised at the suture, moderately dilated and rounded below; lip acute, a little produced in the middle; the inner lip slightly convex, a little thickened; columella bearing one very oblique strong fold.

Alt. 8½, diam. 4½ mill. (*Nev.*).

S. Province of Ceylon.

Cylichna lactuca G. & H. NEV., Journ. Asiat. Soc. Beng. xl. p. 2, pl. 1, f. 2, 2*a*.

T. INVOLUTA G. & H. Nevill. Pl. 27, fig. 91.

Shell cylindrical, solid, white, smooth and shining; whorls 3, joined by a somewhat channelled suture; spire subconic, exserted, the apex submammillate. Lip nearly straight, thin; inner lip somewhat thickened, incurved below; columella uniplicate.

Alt, 8½. diam. 3½ mill. (*Nev.*).

S. Province of Ceylon; Bombay; Penang.

Cylichna involuta NEV., Journ. Asiat. Soc. Beng. xl. p. 3, pl. 1, f. 3, 3*a*.

T. TERES Philippi. *Unfigured.*

Shell small, cylindrical, very smooth, milk-white; spire very short, nearly retuse; spire whorls channelled; aperture linear, the base dilated and distinctly uniplicate. Alt. 2⅔, diam. 1¼ lines. (*Phil.*).

Habitat unknown.

Bulla teres PHIL., Zeitschr. f. Mal. 1851, p. 65.

Shell exactly cylindrical, as in *B. cylindracea*, but spire distinct, showing all the whorls, which are strongly marked by the canaliculation. It is quite solid for the size. (*Phil.*).

T. AMBOINENSIS Watson. Pl. 25, fig. 43.

Shell small, oblong, truncated at the top and a little so in front, with whorls sharply and expressedly angulated above, and very faintly spiralled, a channelled suture, a minute regularly incoiled

apex, a shortish, oblique, toothed, and feebly furrowed pillar, and a small mouth. Sculpture: Longitudinal—the lines of growth are barely visible. Spirals—a little way below the middle a minute and very shallow furrow is found; below this, at about five times the breadth of the furrow, is another similar, then at half the distance below is another furrow, after which others succeed, becoming more crowded and slightly stronger on the point of the shell; above there are none of these furrows, only round the top of the whorls runs a sharp keel expressed by a rounded furrow on its outer side and by a deeper and stronger furrow on its inner side. Color translucent glossy-white. Whorls 3½. Mouth barely the length of the shell, narrow, straight, small, enlarging quickly, but to no great extent. Outer lip rather thick, almost appressed above, but separated from the body by the sutural canal; it reaches the top of the shell, but retreats a good deal at this part; its edge line is curved and it is contracted at the middle, in front the edge retreats and is sub-emarginate on the base, where it is considerably thickened by the extention of the pillar tooth, which is continued round the front within the edge of the lip, and separated from the edge by a minute furrow. Top: the shell is slightly contracted, and then sharply and flatly truncate; round the edge and coiling in to the centre is a sharp, expressed keel; the whole interval between one keel and the next is occupied by the deep, perpendicular-faced sutural canal, the horizontal top of the whorl, and the extracarinal furrow; the apex is perfectly flat, and is minute and regularly incoiled. Inner lip: a strongish glassy defined callus runs down the rather cylindrical body, disappears in the extra columellar furrow, and reappears in the extreme edge of the outer lip; a strong oblique tooth twists round the base of the pillar, is flattened back on the pillar, and is continued in a small intralabral callus on the base; behind the pillar edge is a strongish but shallow furrow, but no umbilical chink. Alt. 0·083 in. diam. 0·042. Mouth, breadth at same place, 0·009 inch. (*Wats.*).

Amboina, 15 to 25 fms.

Utriculus (*Tornatina*) *amboinensis* Wats., J. L. S. L. xvii, p. 330; Chall. Rep. Gastr., p. 659, pl. 49, f. 7.

This species is at first sight and especially in rolled specimens when the sculpture is effaced, deceptively like *Utriculus aratus;* it is really, however, quite different, and in particular the difference

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may at once be recognized in the top of each. The species seems considerably to resemble *Bulla* (*Tornatina*) *polita* A. Adams, from Manilla, but the lip is not posteriorly produced. (*Wats.*).

T. MARIÆ Tenison-Woods. *Unfigured.*

Shell small, ovate, thin, white, smooth and polished; spire slightly exserted; whorls 5; nucleus situated vertically; suture deeply channelled; aperture narrow, scarcely constricted in the middle, the labrum acute, the columellar lip thickened and twisted in front.

Alt. 5, diam. 2, spire hardly 1·5 mill. (*T.-W.*).

North-west coast of Tasmania (Petterd).

Tornatina mariæ T.-W., Proc. Roy. Soc. Tasm. for 1876, p. 155.

T. PACHYS Watson. Pl. 24, fig. 33.

Shell rather large, gibbously oval, being tumid in front and contracted upwards, truncated above, where the edge is carinated and furrowed, with an impressed top and a papillary apex. Sculpture: Longitudinals—the lines of growth are few, sinuous, and very slight. Spirals—round the edge of the impressed top is a rounded keel, with an exterior strongish rounded-furrow, outside of which is a narrow sharpish keel; within the apical pore the whorls are sharply keeled above the channelled suture; the only other trace of spiral striation is behind the outer lip, where the fresh shell shows some trace of a spiral texture. Color horny yellowish-white. Mouth club-shaped, large, the full length of the shell being a little produced posteriorly, shortly curved across the body, ample in front. Whorls 4, the earlier ones only indistinctly visible in the impressed top; the apex is papillary. Suture deeply channelled, with a sharp keel above it; this keel runs out not above but on the edge of the funnel-shaped top. Outer lip rises from the inner side of the apical depression, and slopes flatly outwards, forming thus the patulous opening of the funnel-shaped depression; at the apical keel it is angulated; from this point it makes a convex sweep, which has a slight-contraction about the middle; it is patulous and somewhat elliptical in front. Top nearly flat, only the outer lip rises slightly above the level; the apical depression is funnel-shaped, having a wide converging mouth and a small, not deep hole in the middle, with a papillary apex in the centre. Inner lip; a broadish distinct white glaze extends across the body, on which the curve of the lip is very regularly convex on to the narrow, long, low and twisted

pillar tooth; beyond this the pillar lip is slightly concave, narrow, a little patulous, and appressed. Alt. 0·23 in. diam. 0·14 in.; mouth, breadth at same place, 0·04. (*Wats.*).

I do not know any other *Utriculus* so rounded in its outlines as this; it is also very broad relatively to its length. (*Wats.*).

Northeast from New Zealand, Lat. 37° 34′ *S., Long.* 179° 22′ *E* 700 fms.

Utriculus (*Tornatina*) *pachys* Wats., J. L. S. L. xvii, p. 331; Chall. Rep. Gastr. p. 660, pl. 49, f. 8.

T. arata Watson. Pl. 25, fig. 42.

Shell small, oblong, truncated at the top, rounded in front, but not truncated, with whorls sharply angulated above and furrowed spirally from end to end, a channelled suture, a papillary apex, a longish, concave, toothed, and furrowed pillar, and a small mouth. Sculpture: Longitudinals—the lines of growth are very feeble. Spirals—from end to end the shell is scored with small but distinct furrows, which on the front of the shell are rounded, but above sharper, shallower and fretted; they are parted by flattish surfaces of double their width in front, but much more than this above, where the furrows are slighter; round the top of each whorl runs a sharp upstanding keel, within which lies the deepish and narrow, but at bottom rounded, sutural canal. Colour ivory-white, with a dull gloss. Mouth barely shorter than the shell, narrow, curved, slowly enlarging, elongately pear-shaped. Whorls barely 3. Outer lip almost appressed above, but separated by the sutural canal; it does not rise quite to the top of the shell, it is very slightly arched, and the edge is scarcely curved, and is hardly emarginate in front. Top: the shell is narrowed and there sharply and flatly truncate; round the edge and coiling in to the centre is a sharp but not expressed keel; the whole interval between the keel of one whorl and that of the next is occupied by the sutural canal, which has a convex slope on the interior side, a rounded bottom, and a perpendicular face on the exterior whorl; the central tip is a (relatively) large, glossy, translucent, flatly rounded prominent dome. Inner lip; there is a very thin glaze across the slightly arched body; round the base of the straightish concave pillar coils a strongish tooth, minutely furrowed longitudinally, and with a sharp twisted inner edge; outside the tooth-edge is a strong furrow with a

minute umbilical chink. Alt. 0·083 in., diam. 0·041. Mouth, breadth at same place, 0·011 inch. (*Wats.*).

West of Cape York, off south-west point of Papua, 28 fms.

Utriculus (*Tornatina*) *aratus* Wats., J. L. S. L. xvii, p. 329; Chall. Rep. Gastr., p. 658, pl. 49, f. 6.

This species very much resembles T. amboinensis, but may at once be distinguished by the top.

T. LEPTEKES Watson. Pl. 24, figs. 29, 30.

Shell rather small, thin, oblong, cylindrical, rounded on the shoulder, very fine pointed, with sinistral upturned apex, narrowed in front, spirally striate, with long, narrow, slowly widening mouth. Sculpture: Longitudinals—the lines of growth are very slight and regular. Spirals—the whole surface is scored with sharp-cut fine furrows, which are about half the width of the interstices; round the top of the whorls runs a slight but sharp-edged axial keel. Colour almost hyaline white from the extreme thinness of the shell. Mouth a little shorter than the shell, very elongately and slightly curvedly pear-shaped, rather narrow above and there channelled. Whorls 3, besides 1½ in the sinistral embryonic apex. Outer lip very gently curved; its edge line retreats very much above and in front. Top: there is a very short scalar spire, in which the first regular whorl is elevated and is truncately conical, the second hardly shows above the third; in the middle rises the small sinistral, more than half turned over apex; the sutural canaliculation is a shallow rounded furrow, with a sharp-edged external border carinating the whorls. Inner lip; there is a thin but distinct labial pad; the curve of the body is convex, and contracts slowly from the top of the mouth to the front, which is not truncated; the pillar is long, oblique, with a small reverted lip and a very slight-long-twisted tooth, behind which is a feeble furrow, caused by an impression made in the shell. Alt. 0·14 in. diam. 0·06 inch. Mouth, breadth at same place, 0·02 inch. (*Wats.*).

Raine Island, Cape York, Australia, 155 fms.

Utriculus (*Tornatina*) *leptekes* Wats., Journ. Linn. Soc. Lond. xvii, p. 327; Chall. Rep. Gastr., p. 656, pl. 49, f. 3.

This species differs from *Utriculus acrobeles* in its narrower form and thinner texture, in its sculpture, in its larger mouth, in its spire, it sutural canaliculation, and its apex, which is more prominent. (*Wats.*).

T. ACROBELES Watson, Pl. 24, figs. 31, 32.

Shell rather small, spirally scored, oval, subcylindrical, bluntly rounded in front, with a low subscalar spire crowned with a minute prominent sinistral apex turned up on its side. Sculpture: Longitudinals—there are faint growth-furrows drawn at the top into short very oblique folds. Spirals—the whole surface is scored with fine furrows, which are remote above but closer in front, where the intervening surface is rounded; a rounded keel lies below the suture. Colour trauslucent white. Mouth markedly shorter than the shell, straightish, clavate to pear-shaped, narrow and channelled above. Whorls 4, exclusive of 1½ of the apex which is sinistral. Outer lip straight, very slightly appressed above, where it is separated from the body of the slight, shallow sutural canal. Top: there is a short distinct subscalar spire, in which the first regular whorl hardly shows, but which is crowned with the small sinistral half-turned over apex. Inner lip: there is a thin but distinct labial pad; the curve of the body is nearly straight, but is convex in front; the pillar is very oblique, broad, flat and patulous, with a very broad, scarcely twisted tooth, which is longitudinally furrowed so as almost to be double; in front of this tooth the pillar is truncated at its junction with the outer lip. Alt. 0·13 in., diam. 0·055. Mouth breadth at same place, 0·014 inch. (*Wats.*).

Wednesday Island, Cape York, Northeast Australia, 8 fms.

Utriculus (*Tornatina*) *acrobeles* WATS., Journ. Linn. Soc. Lond. xvii, p. 327; Chall. Rep. Gastr., p. 657, pl. 49, f. 4.

This differs from *Utriculus avenarius* in the shape of the shell and of the spire, and in the apex and pillar. *Utriculus canaliculatus* (Say), is much stumpier, and has a lower spire. The upturned apex is like that of *Odostomia lactea*. (*Wats.*).

T. APICINA Gould. *Unfigured.*

Shell minute, cylindrical, elongated, white, sculptured with very delicate growth-lines; apex mamillated; whorls 4; suture channelled. Aperture three-fourths the length of the shell, very narrow; columellar fold obsolete; lip arcuate when viewed in profile.

Alt. 5, diam. 2 mill. (*Gld.*).

Sydney Harbor, N. S. Wales, Australia.

T. apicina GLD., Proc. Bost. Soc. N. H. vii, p. 139, 1859; Otia, p. 112.—TENSION-WOODS, P. L. S. N. S. W. ii, p. 256.

The aperture is broader and pillar fold less definite than in *T. fusiformis* (*Gld.*).

Compare *T. brenchleyi* Angas.

T. BRENCHLEYI Angas. Pl. 22, figs. 35, 36.

Shell ovately cylindrical, white, shining, very finely striated by the lines of growth, and exhibiting only faint traces of spiral striation; whorls 4½, the two apical ones forming a small tubercle, the rest somewhat elevated, turreted, and separated by a deeply but not broadly channeled suture; aperture narrow above, gradually dilating and curved at the base; the outer lip not extending to the top of the whorl and slightly contracted in the middle; the columella furnished with a stout callus plication, which is connected above with the labrum by a thin callous deposit on the whorl.

Length 3 lines, breadth 1¼ lines. (*Ang.*).

Dredged outside Port Jackson Heads in 10 fathoms water (Brenchley).

T. brenchleyi ANG., P. Z. S. 1877, p. 40, 189, pl. 5, f. 20.

T. AVENARIA Watson. Pl. 24, figs. 37, 38.

Shell oval, rounded bluntly in front and sharply above where the papillary apex projects, smooth, angulated above round the outside of the channelled suture, with a strongly toothed twisted oblique pillar, and a smallish mouth, which is shorter than the shell. Sculpture: Longitudinals—there are faint rounded furrows on the lines of growth. Spirals—on the upper part of all the whorls there seem to be close-set very faint spirals; about the middle of the whorl they become stronger, like very fine remote furrows; a bluntly angulated keel projects axially below the suture. Colour translucent white. Mouth a good deal shorter than the shell, conically elavate, slightly curved, a little blunt at the top. Whorls 4 to 4½, angulated above; each rises distinctly above the one which follows. Outer lip almost appresed above, but separated by the deep sutural channel which runs into the top of the mouth; in front it is very patulous, and obliquely truncate backwards, in the middle it is slightly contracted. Top: the whole upper part of the shell contracts and the spire is roundly conical and subscalar, with the glossy round papillary apex rising slightly above all; it is scored with the sutural canal, which is narrow and not deep, but well defined by the sharp keel which lies below it. Inner lip; there is a thick prominent labial pad; the

curve of the body is convex, and so passes on regularly to the point of the pillar, which is very oblique and carries a strong, twisted, oblique, longitudinally furrowed tooth; between this tooth and the body is a very small furrow. Alt. 0·22 in. diam. 0·1. Mouth, breadth at same place, 0·02. (*Wats.*).

Port Jackson, Sydney, N. S. Wales, 2–10 fms.

Utriculus (*Tornatina*) *avenarius* Wats., J. L. S. L. xvii, p. 328; Chall. Rep. Gastr. p. 658, pl. 49, f. 5.

Compare *T. apicina* Gould, and *T. brenchleyi* Angas.

This species a good deal resembles, not the *Bulla turrita* Möll., but Sowerby's figure of that species in Thesaurus, pt. 2, pl. cxxi, fig. 28. In perfectly fresh specimens the spiral furrows, which I have described as very faint, may be distinct; but in the ten Challenger specimens they are only traceable with certainty near the edge of the labial pad. *Utriculus canaliculatus* (Say), is a much smaller and stumpier form, much broader above with a minute apex turned over on its side. (*Wats.*).

T. hofmani Angas. Pl. 22, figs. 37, 38.

Shell cylindrical, white very finely striated by the lines of growth, with a few distant irregular transverse striæ discernible toward the lip on the body-whorl; whorls 5½, the upper ones slightly convex, and channelled at the sutures, the last a little shouldered above and very slightly concave in the middle; apex sharp; aperture narrow above, dilated below, and rounded at the base; outer lip thin, arched when viewed laterally, and slightly contracted in the middle; columella somewhat thickened below, with a small blunt flexuous projection near the base, and covered by a callus extending nearly to the top of the whorl. Length 3½ lines, breadth 1½ lines. (*Ang.*).

Sow and Pigs reef, Port Jackson (Brazier).

T. hofmani Ang., P. Z. S. 1877, p. 39, 189, pl. 5, f. 19.

Evidently not a typical *Tornatina*.

Genus RETUSA Brown, 1827.

Retusa Brown, Ill. Conch. Gr. Brit., Edit. 1, 1827; Conch. Textbook (edit. 4), p. 97. Buq. Dautz. & Dollf., Moll. Rouss., p. 527, —*Coleophysis* Fischer, Manuel de Conch., p. 555, 1883, type *truncatulus* Brug.—*Utriculus* Brown (in part), Ill. Conch. Gt. Brit., 1844 (2 edit), p. 58. Not *Utriculus* Schumacher, 1817 (*Conidæ*).

—*Cylichnina* Monts., Nom. Gen. e. Spec., p. 143, 1884, type *B. umbilicata* Mont.

Shell small, sub-cylindrical, imperforate, with slightly raised, flat, or depressed spire, the aperture as long, or nearly as long, as the shell, narrow above, dilated below. Columella thickened, with a small fold or none.

Animal (pl. 60, figs. 1, 2, 3, *R. truncatula;* pl. 60, fig. 5, *R. nitidula*) capable of being retracted into the entirely exposed shell, the head-shield short, produced backward in two narrow lateral tentacular processes. Radula wanting. Gizzard provided with three small, elliptical corneous plates, irregularly tuberculate-dentate on their inner faces, the tubercles longer near one end of the plates (pl. 60, fig. 7, stomach of *R. nitidulus* containing gizzard-plates and foraminifera. Fig. 6, plates of the same species. Fig. 8, plates of *R. umbilicata.* Fig. 4, one plate of *R. truncatula*).

This genus differs from *Cylichna* in wanting radula-teeth, in the posterior processes of the frontal disc, in the peculiar gizzard-plates, and in the exposed spire of the shell.

The species of this genus might be distributed into two groups, as Fischer has done. Part of them have a distinct fold on the columella, as in *Tornatina*, and for these the genus *Retusa* Brown was proposed, and also *Coleophysis* Fischer, the types of both being *Bulla truncatula* Brug. The other species have no distinct columellar fold, although the pillar-lip is thickened; and these fall into *Utriculus* as understood by Sars, Fischer, Dall and others. As this name is preoccupied in zoology, it must be rejected; and if the division is to be retained a new name must be coined for the forms like *obtusa, pertenuis*, etc. The value of the distinction seems to me to be hardly worth a name, however, as the strength of the columellar fold is subject to great mutation, and it would be very difficult to decide upon the position of certain species in which the fold is slight, thus bridging the gap between the extreme forms of either group. Dall's proposition to make "*Coleophysis*" a subgenus of *Tornatina* and *Utriculus* a distinct genus with *Retusa* as a subgenus cannot be adopted, being barred by taxonomic canons. Monterosato's group *Cylichnina* has generally been placed in or next to *Cylichna*, but, according to Sars's observations, belongs to *Retusa* It is distinguished by the narrowly, deeply umbilicated apex. What arrangements may be made when the soft parts of these small dwellers in the deeps come under scalpel and microscope, cannot now be guessed; the only thing certain is change.

R. TRUNCATULA Bruguière. Pl. 21, figs. 11, 12; pl. 23, figs. 62–64.

Shell forming a conical cylinder, narrow on the upper half, more or less deeply constricted in the middle, and expanding on the lower half; it is nearly opaque and glossy: sculpture—numerous longitudinal striae or fluted ribs on the upper half; these are often sharp at the apex, not so distinct in the middle of the shell, and usually disappear towards the base, where they are replaced by lines of growth; the spire is frequently striated across, like an Ammonite; epidermis filmy; color white; spire involute, abruptly truncated, and encircled by a narrow and solid rim or rounded keel; whorls 3–4, gradually decreasing in size towards the center of the apex; the first or innermost whorl is globular; suture deep; mouth narrow for more than half its length on the upper part, pear-shaped and very wide at the base, which is rounded: outer lip gently curved and folded inwards in the middle; the upper part projects (sometimes considerably) beyond the apex; outer corner rounded; inner corner receding and obliquely incurved; inner lip slight, continuous with the outer lip above, where it is folded a little over the apex, as well as over the pillar, behind which it forms a small and narrow umbilical chink; pillar short, thick, and flattened: fold tooth-like and strong (*Jeffr.*).

Coast of Norway to the Canaries; Mediterranean and Adriatic Seas.

Bulla truncatula BRUG., Encycl. Méth., p. 377, 1792.—*Utriculus truncatulus* JEFFR., Brit. Conch., iv, p. 421, pl. 94, f. 2.—SARS, Moll. Reg. Arct. Norv., p. 285, pl. 26, f. 2; pl. 17, f. 18 (var. *pellucida*).—*Retusa truncatula* BUQ., DAUTZ. & DOLLF., Moll. Rouss., i, p. 527, pl. 64, f. 12–14.—*Bulla truncata* AD. (not Gmelin), Tr Linn. Soc., v, p. 1, pl. 1, f. 1, 2.—*Volvaria truncata* BROWN, Ill. Conch., G. B., Ed. 1, pl. 19, f. 17, 18.—*Cylichna truncata* LOVEN, Ind. Moll. Skand., p. 42.—FORBES & HANLEY, Hist. Brit. Moll., iii, p. 510, pl. 114, f. 7, 8; pl. vv, f. 4 (animal).—MEYER & MOBIUS, Fauna der Kieler Bucht, i, p. 87 (animal).—*Bulla retusa* MATON & RACK., Descr. Cat. in Trans. Linn. Soc., viii, p. 128, 1804.—*Retusa obtusa* BROWN, Pop. Encycl., ii, p. 78, pl. 17, f. 110.—*Volvaria pellucida* BROWN, Ill. Conch. G. B. Edit. 1, p. 4, pl. 19, f. 45, 46.—*Utriculus truncatulus* var. *pyriformis* MONTS., Nom. Gen. e Spec., p. 50.

Var. PELLUCIDA Brown, Pl. 23, fig. 68.

Smaller, shorter, thinner and more transparent, slightly less strongly ribbed or sometimes quite smooth; epidermis slightly prismatic (*Jeffr.*).

Scotland and Norway.

R. TRUNCATELLA Locard. *Unfigured.*

Subconic-elongated, well contracted and longitudinally plicate above, with two opaque bands at middle and base of the last whorl. Spire quite concave; last whorl highest at its upper extremity, with straight profile; columella feebly folded. Alt. 3–4, diam. 1½–2 mill. (*Loc.*).

Mediterranean

Cylichna truncatella LOCARD, Prodr., p. 73, 533; Coq. Mar. des Cotes de Fr., p. 28, 1892.

R. SEMISULCATA Philippi. Pl. 23, figs. 70, 71, 72.

Shell thin, cylindrical, elongated, truncated at summit, visibly constricted around the middle, and dilated at base. Spire a little concave, composed of 3 or 4 visible whorls separated by a well-marked suture. Surface of the last whorl traversed from summit to middle by numerous nearly vertical longitudinal folds. Aperture elongated, narrow above, dilated and pyriform toward the base; lip simple, sinuous, a little bent in the middle; columellar margin very feebly sinuous. Columella thick, arcuate and twisted at base. Color milk white, nearly opaque, with a wide, descending, more transparent band below the middle, and sometimes several narrow transparent lines below it. Alt. 3·2, diam. 1·33 mill. (*B., D. D.*)

Mediterranean and Adriatic Seas, littoral and laminarian zones.

Bulla semisulcata PHIL., Enum. Moll. Sicil. i, p. 123, pl. 7, f. 19. —*Retusa semisulcata* BUQ., DAUTZ. & DOLLF., Moll. Rouss., p. 530, pl. 64, f. 15–17.—?? *Bullina striata* RISSO, Hist. Nat. Eur. Mérid., iv, p. 52.

More elongated than *R. truncatula*, with straighter longitudinal folds, and a wide transparent zone.

R. MAMILLATA Philippi. Pl. 23, figs. 65, 66, 67.

Shell convoluted, subpellucid, shining, truncated at summit, of a regularly cylindrical form, a little constricted in the middle. Spire composed of 3 whorls, the first globular and projecting; suture profound. Sculpture consisting of exceedingly finely punctured spiral striæ. Aperture narrow, nearly linear above, dilated and

pear-shaped below; lip visibly flexuous, inflected in the middle; columellar margin nearly straight. Columella a little thickened, arcuate, without apparent fold. Color transparent white. Alt. 2·5, diam. 1 mill. (*B., D. & D.*).

Mediterranean and Adriatic Seas; Atlantic from Norway to the Canaries, laminarian zone.

Bulla mammillata PHIL., Enum. Moll. Sicil. i, p. 122. pl. 7, f. 20; ii, p. 96.—*Cylichna mamillata* FORBES & HANLEY, Hist. Brit. Moll. iii, p. 514, pl. 114c, f. 4, 5.—*Utriculus mamillatus* JEFFR., Brit. Conch., iv, p. 420; v, p. 223, pl. 94, f. 1.—*Retusa mamillata* BUQ., DAUTZ. & DOLLF., Moll. Rouss., p. 531, pl. 64, f. 18–20.—*Bulla minuta* MACGILL., *teste* Jeffr.

Distinguished by the projecting apex and cylindrical form. Except in lacking a columellar fold, this species resembles *Tornatina*.

R. MARIEI Dautzenberg. Pl. 24, figs. 34, 35, 36.

Shell 1 mill. high, 2 mill. wide, minute, subsolid, convoluted, cylindrical, longitudinally arcuately striated, truncate above, contracted in the middle, dilated toward the base. Whorls 3–4, the penultimate obliquely projecting above the last. Suture little impressed. Aperture as long as the shell, straight and a little thick ened; lip simple, sinuous, inflexed in the middle, expanded anteriorly. Color milky, with a subhyaline zone at the middle (*Dautz.*).

San Miguel, Azores.

Tornatina mariei DAUTZ., Contrib. à la Faune Malac. des Iles Açores, Rés. Camp. Sci., Albert I, p. 21, pl. 1, figs. 3*a*–3*d*, 1889.

This interesting species seems distinct from all others of European seas, being well characterized by the formation of the summit. In *T. mamillata* Phil., only the first whorl of the spire projects; in *T. mariei* this whorl is impressed, and the next-to-the-last whorl is prominent (*Dautz.*).

R. OLIVIFORMIS Watson. Pl. 25, fig. 50.

This large and very interesting species is in too bad condition for satisfactory description. I had called it *Utriculus oliviformis* from its shape, which is peculiarly stumpy, with an excessively short and broad mouth, and an unusually high and blunt spire; it is sharply fretted all over with spiral lines, and has a strong, little furrow behind the sharp-edged twisted pillar. It is like *Utriculus culcitella* Gould, or *Utriculus lactuca* Nevill, in its conical spire, and like

Utriculus simplex A. Adams in shortness of body. *Tornatina olivula* A. Adams is much slimmer, longer in the mouth, and much more cylindrical. It differs from *Utriculus spatha* Watson in its greater breadth, higher spire, shorter mouth, coarse, sculpture, more numerous whorls, and more abrupt truncation in front, where the shell is cut off almost at right angles to the axis. Alt. 0·32 in., diam. 0·17. Mouth, height 0·2, breadth 0·05 (*Wats.*).

West of the Azores, 1000 fms. (Challenger).

Utriculus oliviformis Watson, Journ. Linn. Soc. Lond., xvii, p. 332.—*Utriculus n. sp.* Watson, Chall. Rep. Gastr., p. 648, pl. 48, f. 6.

R. leucus Watson. Pl. 21, fig. 1.

Shell strong, cylindrical, with a very slight upward taper, rounded at either end, with an oblique flat apex and a minute perforation round which the edge of the penultimate whorl is visible, and in the middle the sunken apex; the mouth is small and narrow, and in front abruptly truncate, with a short truncate very bluntly toothed pillar. Sculpture: Longitudinals—there are slight, unequal furrows on the lines of growth. Spirals—the whole surface is most faintly and doubtfully marked with very feeble furrows, both narrow and superficial, parted by broadish, flat interstices. Color translucent white, with faint brownish tinge, glossy. Mouth large, narrow, shorter than the shell, straight, with parallel sides, the enlargement in front sudden but very short. Outer lip straight, rounded above, where it springs from the callus of the inner lip; it does not rise so high as the opposite side of the apex, which consequently is rather oblique; its edge line is slightly produced in the middle, but not bent in; in front, the lip, in common with the whole shell, is very abruptly truncate, and here it sweeps round with a strong, sharp, bevelled edge to join the pillar lip. Top roundly flattened down and slightly bent in, round the small apical perforation—round which 1½ to 2 whorl edges are visible. Inner lip: across the body runs a strongish callus, whose edge is parallel to the edge of the outer lip; in front it is flatly and broadly appressed on the very stumpy pillar, round which twists a strongish but very blunt tooth. Alt. 0·25 in., diam. 0·11. Breadth of mouth at same place, 0·03 (*Wats.*).

West of Azores, 1000 fms. (Challenger).

Utriculus leucus Wats., J. L. S. L., xvii, p. 334; Chall Gastr., p. 649, pl. 48, f. 8.

This species is very like *Cylichna alba* (Brown), but is squarer both above and below, the obliquity of the line of the top is exactly the opposite of that *Cylichna alba*, where from the outer lip rising above the top of the shell, the greatest height is at the mouth; while in *Utriculus leucus*, the top is highest on the side away from the mouth. *Utriculus vortex* Dall, appears to present several points of resemblance; but that species seems to taper much more toward the tip, to be differently and much more strongly sculptured, to have no pillar tooth, and to be very much broader in proportion to height. Alt. ·3 in., diam. 0·17 in. The *Tornatina eximia* Baird has a more perfectly cylindrical form, a higher spire, and a much wider mouth (*Wats.*).

R. TORNATA Watson. Pl. 21, fig. 3.

Shell small, cylindrically oblong, a little tumid in front, slightly narrowed backwards, rounded at the shoulder, longitudinally and spirally striate, with a flat top, a small papillary apex and straight club-shaped mouth. Sculpture: Longitudinals—there are many fine, rounded, feeble lines of growth. Spirals—there are many very faint minute superficial spiral lines which owe somewhat of distinctness to the color, and to the fact that at somewhat regular intervals there occurs one a little stronger than the rest. Color transparent white, irregularly banded with unequal spiral milky stripes, which are obsolete in many specimens. Mouth club-shaped, the full length of the shell, long and narrow above, slightly enlarged at the top, considerably so in front by the contraction of the body-whorl at the base. Whorls 3, far from distinct, slightly rounded, of very gradual increase; the extreme apex is minute, but papillary. Outer lip rises very slightly above the flat crown, and here it is very patulous, and almost emarginate; just where it begins to run forward it is very slightly expanded, from this point to the base it advances quite straight, and a little inflected; on the base it is freely rounded, truncated and patulous. Top is barely oblique, and the rise of the outer lip elevates that side, so that the whole top is almost flat, with more or less of a depression in the middle where the minute dome-shaped apex rises. Inner lip: there is a strong, well-defined labial glaze which runs quite straight and continuously from the outer lip across the scarcely convex body, and passes on with a quick deflection to the left into the slightly concave, scarcely toothed, oblique, truncated pillar, where the lip is narrow, expanded, and appressed,

with a minute furrow behind. Alt. 0·092 in., diam. 0·046. Breadth of mouth at same place, 0·005 inch (*Wats.*).

Madeira; *Tenerife, Canaries*, 78 fms.

Utriculus tornatus WATS., J. L. S. L., xvii, p. 335; Chall. Rep. Gastr., p. 651, pl. 48, f. 10.

This is a species extremely abundant at Madeira, where I dredged many thousand specimens. They vary somewhat in the relation of length and breadth, and still more in the form of the crown, which is sometimes flat and broadish, with an impressed suture, at other times narrow, with a small, deep opening and a very depressed apex, the sutures in these circumstances being out of sight. I should expect to find this species among Mediterranean shells, but have not been able to identify it. It is not unlike *Utriculus mamillatus* (Phil.), but is stumpier and not so cylindrical, being broader in front and more tapering backwards; its papillary apex, too, is much smaller and more sunken into the crown of the shell than it is in that species: the whole crown is very much like that of *Utriculus truncatulus* (Brug.), but the characteristic constriction and sculpture of that species are wanting (*Wats.*).

R. UMBILICATA Montagu. Pl. 29, figs. 11, 12, 13, 14.

Shell oblong, not so much attenuated behind as *R. nitidula*, more solid, nearly opaque, and glossy but not prismatic; sculpture slight and sometimes wavy spiral striæ or impressed lines, which vary in strength and remoteness on the body, and are more or less close-set near the base; they are visible in fresh specimens by means of a low magnifying power, but are not easily observable in rubbed specimens picked out of drift sand; epidermis brownish-yellow, liable to peel off; color creamy, becoming bleached and white in dead shells; mouth somewhat open at the top, contracted and narrow in the middle, pear-shaped and wide at the base, where it is expanded and rounded; outer lip gently curved; the upper part is obliquely truncated, but it does not project so far beyond the apex or crown as in *R. nitidula*; apex twisted and somewhat contracted, encircled by a solid white rim ("periomphalus," Lovén), and exhibiting a perforation in the center like that of *C. nitidula*; inner lip as in *R. nitidula*; pillar short and thick, furnished with a rather strong tooth-like fold near the base; it has a sharp curve to the left. (*Jeffr.*).

Alt. 2·5, diam 1·2 mill.

Norway to Gibraltar; Mediterranean and Adriatic Seas.

Bulla umbilicata Mont., Test. Brit. (i), p. 222, pl. 7, f. 4.—*Cylichna umbilicata* Forbes & Hanley, Hist. Brit. Moll. iii, p. 519, pl. 114c, f. 8, 9.—Jeffr., Brit. Conch. iv, p. 413; Ann. Mag. 1880, p. 318.—*Utriculus umbilicatus* Sars., Moll. Reg. Arct. Norv. p. 286, pl. 17, f. 14.—*Cylichna strigella* Loven, Ind. Moll. Skand. p. 142. —*Bulla blainvilliana* Récluz and *Volvaria subcylindrica* Brown, *teste*, Jeffr.—*Bulla truncatula* Phil., Enum. Moll. Sicil., i, p. 122, pl. 7, f. 21 (not of Brug.).—*Cylichnina umbilicata* Monts., Nom. Gen. e Spec. p. 143.—*Cylichna* (*Cylichnina*) *umbilicata* Buq., Dautz, & Dollf., Moll. Rouss. i, p. 524, pl. 64, f. 6–8.

This species is the type of Monterosato's genus *Cylichnina*. Differs from *nitidula* in being somewhat broader in proportion to its length, and not so much attenuated behind, being spirally striated instead of smooth, having frequently a conspicuous epidermis, in the upper angle of the outer lip not being so prominent, the apical perforation being larger, and the columellar fold more distinct (*Jeffr.*).

R. crebrisculpta Monterosato. Pl. 27, figs. 7, 8.

The form is as in *R. umbilicata*, but it is larger, solider, date-shaped, the top more attenuated and profoundly umbilicated. The sculpture is composed of vertical and spiral striæ, which give it a rough appearance (*Monts.*).

Palermo; Naples; Gulf of Gascony.

Cylichnina crebrisculpta Monts., Nomencl. Gen. e Spec. p. 143. —Dautzenberg, Mem. Soc. Zool. France, iv, p. 613, pl. 16, f. 1, 2.

R. lævisculpta Granata. *Unfigured.*

Shell of quite lengthened, subcylindroid form, contracted above; with very fine spiral striæ; summit truncated; spire profoundly and very narrowly umbilicated; last whorl flattened above, rounded at the base. Aperture narrow in the middle; columella with a strong fold. Alt. 2–2½, diam. 1¼–1½ mill. (*Locard.*).

Marseilles to Italy and Sicily; Malta.

Cylichna lævisculpta Granata, Descr., etc., Nap., p. 11, 1877.—Locard, Coq. Mar. Fr. p. 27.—*Cylichnina lævisculpta* Monts., Nom. Gen. e Spec. p. 143.

R. crossei Buquoy, Dautzenberg & Dollfus. Pl. 29, figs. 8, 9, 10.

Shell 2 mill. high, 1 mill. wide, convoluted, thin, semipellucid, of an ovate form; summit truncated, the spire sunken, having a very narrow and deep central perforation. Surface shining, a mi-

croscope showing arcuate growth lines and extremely fine descending spiral striæ toward the base. Aperture as long as the shell, narrow and nearly linear above, pyriform at the base: lip arcuate, simple, sharp; columellar margin convex; columella thick, twisted, provided with a well marked fold. Color uniform hyaline white (*B. D. & D.*).

Eastern basin of the Mediterranean.

Cylichna (*Cylichnina*) *crossei* B. D. & D., Moll. Mar. Rouss. i, p. 526, pl. 64, f. 9–11.

Smaller than *R. umbilicata*, more regularly oval, not contracted at the summit nor enlarged at the base and the aperture is not wider at summit than in the middle.

R. STRIATULA Forbes. *Unfigured.*

Shell oblong, cylindrical, milk-white; transversely undulately striated, longitudinally obsoletely striated; vertex subtruncate, concave; spire visible; aperture linear above, dilated below, Length one-eighth inch (*Fbs.*).

Rio, Macri, Servi, Crete, etc., Ægean Sea (*Forbes*); *Bay of Naples* (*Tiberi*).

Bulla striatula FBS., Rep. Ægean Invert. Brit. Asso. Rep. for 1843, p. 188.—*Utriculus striatulus* JEFFR., Ann. Mag. N. H. (4), vi, p. 84.—[? *Bulla* (*Cylichna*) *pyramidata* A. Adams, *teste* Jeffreys]. —*Cylichna hoernesi* WEINKAUFF, Conchyl. des Mittelm. ii, p. 197; Bull. Mal. Ital. iii, p. 92.—*Cylichna cuneata* TIBERI, Journ. de Conchyl. 1868, p. 181, *teste* MONTEROSATO, Journ. de Conch. 1878, p. 159.—WEINKAUFF, Bulletino Malacologico Italiano, iii, p. 92, 1870.

This species is still unrecognizable to those who have not seen authentic specimens. It is a pity that so many of the Mediterranean shells are still insufficiently described and unfigured, notwithstanding the large literature upon them, and the multitude of lists by Jeffreys, Monterosato and others.

R. NITIDULA Lovén. Pl. 23, fig. 54; pl. 60, fig. 5.

Shell thin, subpellucid, white, oblong-cylindrical, rather narrow, more than twice as high as wide; slightly tapering toward the apex, where it is obtusely truncated and narrowly perforated in the middle, the spire indistinct. Aperture very narrow in the middle, dilated below, the outer lip projecting a little above the vertex,

lightly inflexed in the middle; columella short, receding, hardly folded. Surface very smooth and a little shining, without spiral lines, the growth striæ rather inconspicuous. Alt. 3·5 mill. (*Sars.*)

Scandanavia; *Northern shores of Great Britain.*

Cylichna nitidula Loven, Ind. Moll. Skand. p. 10.—Forbes & Hanley, Hist. Brit. Moll. iii, p. 515, pl. 114*c*, f. 6.—Jeffreys, Brit. Conch. iv, p. 412.—*Utriculus nitidulus* Sars, Moll. Reg. Arct. Norv. p. 286, pl. 17, f. 13 (shell); pl. 26, f. 3 (animal).

This species has somewhat the aspect of the forms referred to *Cylichnina*, but not their sculpture. Compare *C. umbilicata* Mont. Sars has shown *nitidula* to be a *Retusa* by an examination of the soft parts.

R. robagliana Fischer. Pl. 27, fig. 6.

Shell elongated, cylindrical, whitish, rather solid, not umbilicated, a little dilated below, slightly narrower above; longitudinally densely costellate, the costæ close, regular, not sinuous, and somewhat latticed with spiral striæ, decussating the riblets. Spire umbilicate, excavated. Aperture elongated, with subparallel margins; columellar margin short, reflexed. Alt. 3, diam. 1⅓ mill. (*Folin.*)

Gulf of Gascony.

Bulla robagliana Fischer, in Les Fonds de la Mer, i, p. 150, pl. 23, f. 2; Actes Soc. Linn. Bord. xxix, p. 197.

This species belongs to the group of *nitidula* and *umbilicata*, but is distinguished by the peculiar sculpture of the shell.

R. lactea Jeffreys. *Unfigured.*

A small fragment of another species occurred at Station 12, 1450 fathoms. It consists of the anterior portion of a short cylindrical shell which is of a milk-white color, glossy, and marked with slight, rather distant, spiral striæ or rather impressed lines; the sculpture does not extend to the crown; the apex is semiglobose, and sunk within a sharp obliquely encircling ridge. The species may be called *lacteus*. I also dredged a young specimen of this species in the 'Porcupine' Expedition of 1869, off the west coast of Ireland, at a depth of 1443 fathoms (*Jeffr.*).

North Atlantic.

Utriculus lacteus Jeffr., Ann. Mag. Nat. Hist. (4), xix, p. 334.

R. SUBSTRIATA Jeffreys. *Unfigured.*

Shell represented by a single specimen, which was unfortunately broken in sifting the dredged material. It resembles *Bulla hyemalis* Couthouy (=*Amphisphyra globosa* Lovén, =*Utriculopsis vitrea* M. Sars) except in being smaller, shorter, and equally broad throughout, instead of barrel-shaped; the crown is consequently longer in proportion and not so much raised at the point; but the especial difference consists in this being beautifully sculptured, and not smooth like the other species; besides a few coarse spiral ridges the whole surface is closely and microscopically striated in the same direction. Length 0·1, breadth 0·075 in. (*Jeffr.*).

North Atlantic, 1750 fms.

Utriculus substriatus JEFFR., Ann Mag. N. H. (4), xix, p. 334.

UTRICULUS OBESUS Jeffreys, Rep. Brit. Ass. Adv. Sci. 1880, p. 387. Bay of Biscay (name only).

UTRICULUS PUSILLUS Jeffreys, *l. c.* Same locality (name only).

UTRICULUS EXCAVATUS Jeffreys, *l. c.* Same locality (name only).

R. OBTUSA Montagu. Pl. 23, fig. 51.

Shell forming an oblong cylinder, constricted in the middle, and becoming broader towards the base; it is usually opaque, and rather glossy: sculpture, numerous slight lines of growth; and in young and fresh shells may be somtimes detected under the microscope extremely close-set and fine wavy spiral lines; spire indistinctly striated across; epidermis skin-like, cream-colour passing into brownish-yellow; colour white; spire short, but very variable in that respect, being in some cases almost truncated, while in others it is more or less extended; whorls 4, slightly angulated at the top; those in the middle gradually enlarge; the apical or central whorl is globular and turned inwards; suture deep and narrowly excavated; mouth flexuous, upper half narrow; lower half wide, with a rounded base; outer lip gently curved, never extending to the apex; it recedes above, so as to leave a space between the outermost whorl and the next, and is contracted and inflected in the middle: outer corner rounded; inner corner obliquely incurved; inner lip thicker than in the last species, continuous with the outer lip above; it is reflected over the pillar, behind which it occasionally forms a small

umbilical chink; pillar broad, flattened and curved; fold obscure. (*Jeffr.*).

Alt. 5½, diam. 3 mill.

European Seas, from Godhavn, Greenland, to the Mediterranean.

Bulla obtusa Monts., Test. Brit. (i), p. 223, pl. 7, f. 3.—A. Ad. in Sowb. Thes. Conch. ii, p. 571, pl. 120, f. 20.—*Utriculus obtusus* Jeffr., Brit. Conch. iv, p. 423, pl. 4, f. 2, 3 (animal).—Sowb., Conch. Icon., f. 5.—Jeffr., Ann. Mag. Nat. Hist. (4), vi, p. 84 v. *minor* and (4) xix, p. 333.—*Cylichna obtusa* Locard, Coq. Mar. Cotes France, p. 27, fig. 14.

Var. turrita Möller. Pl. 23, fig. 52.

Shell elongated, nearly twice as high as wide, slightly tapering above; the spire elevated, obtusely conical, with subscalariform whorls. Alt. 3–3½ mill.

Greenland; England; Norway.

Bulla turrita Moller, Ind. Moll. Grœnl., p. 6.—A. Ad., Thes. ii, p. 567, pl. 121, f. 28.—*Utriculus turritus* Leche, K. Svensk. Akad. Handl. 1878, p. 71.—*U. pertenuis v. turritus* Sars, Moll. Reg. Arct. Norv., p. 288, pl. 17, f. 20.—*U. obtusus v. lajonkaireana* Jeffr., Brit. Conch. iv, p. 424.

Var. candidula Locard. *Unfigured.*

Smaller than *R. obtusa*, more cylindrical, with higher spire; last whorl quite descending toward its termination, with more rectilinear profile; aperture smaller and more regularly narrow.

Alt. 2–3, diam. 1¾–2 mill. (*Loc.*).

Atlantic coast of France.

Cylichna candidula Loc., Coq. Mar. Fr. p. 28, 1892.—*C. lajonkaireana* Loc., Prodr., p. 72.

This does not seem to differ materially from the preceding variety.

Var. minor Jeffr.

Apex depressed, *Mediterranean*, 30 fms. (*Jeffr.*). This form has also received the name *Utriculus minutissimus* H. Martin (Journ. de Conchyl. 1878, p. 159.—*Conf.* Locard, Les Coq. Mar. des Cotes de France, p. 29). It is characterized, according to Monterosato, by the small size, and median contraction; the normally flat spire

is rarely mamillate or scalariform. This form is common in the Mediterranean. Alt. 1–1¼, diam. ½–¾ mill.

R. PERTENUIS Mighels. Pl. 23, figs. 48, 49.

Shell small, thin, translucent whitish or light brown, cylindrical, the spire very low-convex; whorls 3½, the first somewhat turned inward; sutures deeply impressed; last whorl descending, sculptured with irregular, light, arcuate growth-striæ. Aperture narrow above, dilated below; outer lip strongly arched forward and bent slightly inward in the middle; columella thickened but not plicate.

Alt. 3·2, diam. 1·8 mill.

Massachusetts Bay; *Fernandina, Fla.*; *Coast of Maine*; *Greenland*; *Norway.*

Bulla pertenuis MIGHELS, Bost. Journ. Nat. Hist. ii, p. 346, pl. 16, f. 3.—*Utriculus pertenuis* GOULD (W. G. B. edit.) p. 218, fig. 509.—SARS, Moll. Reg. Arct. Norv. p. 287, pl. 17, f. 19.—AD., Thes. Conch. ii, p. 371, pl. 120, f. 19.—SOWB., Conch. Icon. f. 4.—DALL, Blake Gastr., p. 45; Cat. Mar. Moll. S.-E. U. S., p. 86.—AURIVILLIUS, Vega-Exped. Vetenskap. Arbeten iv, p. 371.—*Diaphana pertenuis* VERRILL, Amer. Journ. Sci. (3), xx, p. 399.

This species has been united with *R. obtusa* and *R. semen* by many authors, but the three are here retained distinct because proof of their complete intergradation is still lacking. *R. obtusa* seems to be a more solid, larger shell, replacing *pertenuis* in English and southern European waters; *B. semen* is a somewhat shorter form from high latitudes.

R. SEMEN Reeve. Pl. 23, figs. 55, 56, 57.

Shell cylindrical-ovate, rather tumid, the spire depressed convex, suture impressed; whorls smooth, slightly convex, the last a little descending in front; tawny-white. Of a short cylindrical form, somewhat swollen, with a depressly convex spire, having the suture faintly channelled. (*Rve.*).

Port Refuge; *Nova Zemblia.*

Alt. 6, diam. 3½ mill. (*Leche*).

Alt. 4½, diam. 3 mill. (*Leche*).

Bulla semen RVE., in Belcher's Last of the Arctic Voyages, ii, p. 393, pl. 32, f. 4*a-c*, 1855.—*Utriculus semen* LECHE, Kongl. Sv. Akad. Handlingar, xvi, no. 2, p. 71, 1878, (with v. *elongata*).

Leche describes a form with higher spire as Var. *elongata*. It is not the same as *R. turrita* Möll.

Northwest Atlantic and West Indian species.

R. GOULDII Couthouy. Pl. 23, figs. 58, 59.

Shell small, ovate, shining, of a dead white color, covered with a yellowish epidermis; whorls four, rounded at their upper edges, their dividing line well marked; the last whorl is as long as the shell, and includes all the others; under the magnifier its surface appears covered with revolving lines; the whorls all rise to about the same level, so that the summit is nearly flat; the anterior extremity is rather narrower than the posterior; the aperture is narrow behind, and suddenly enlarged by the curvature of the inner margin, which is a little thickened, white, and polished. The outer lip, from its junction behind, advances a little as it turns forward by a regular curve, and finally turning backward by a rather sharp turn, it joins the body of the shell with a gentle twist; umbilicus none. (*Gld.*).

Alt. 7½, diam. 3¾ mill.

Maine to Hatteras.

Bulla gouldii COUTH., Bost. Journ. Nat. Hist. ii, p. 181, pl. 4, f. 6, 1839.—GOULD, Inv. Mass., p. 163, f. 94.—DeKay, N. Y. Moll. p. 15, pl. 5, f. 101.—*Utriculus gouldii* STIMP., Check-lists, p. 4.—GOULD, Inv. Mass. (Binney edit.) p. 217, f. 508.—*Utriculus* (*Retusa*) *gouldii* DALL, Cat. Moll. S.-E. U. S., p. 86.—*Cylichna gouldii* VERRILL, Amer. Journ. Sci. (3), xx, p. 399.—*Aplustrum gouldii* SOWB., Conch. Icon., f. 1.

R. PERPLICATA Dall. Unfigured.

Shell ivory white with a very thin translucent epidermis, marked only with delicate lines of growth and a few faint incised spirals near the columella; anterior half of the shell wide and rounded, posterior half narrowing toward the apex with the sides somewhat compressed or flattened; outer lip thin, straight except in front where it expands a little before rounding to the rather thick twisted pillar; behind deeply notched and behind the notch arching over and turning forward to meet a carina which revolves about the apex; apex truncate, carinated by a line which forms the outer boundary of the path of the notch; within vorticiform, about one and a half whorls visible around the central perforation and descending into it; body with hardly any wash of callus; pillar strong, with a large horizontal fold and a minute chink behind it; aperture as long

as the shell, straight and narrow behind, wide and somewhat oblique in front; max. lon. of shell, 5·0; max. lat. 3·0; lat. of apex, 1·75 mill. (*Dall*).

Off Bahia Honda, Cuba, in 220 fms.; *Barbados*, 100 fms.

Coleophysis perplicatus DALL, Blake Rep. Gastr., p. 45.

It is difficult, or rather impossible, to determine the generic place of these small Tectibranchs without a knowledge of the soft parts. They are referable to *Coleophysis*, *Cylichna*, or *Diaphana*, or even *Sao*, at the option of the describer guided only by the characters of the shell. The presence of the plait would indicate the first mentioned section for the present species. It is perhaps nearest in general form to the *Cylichna ovata* of Jeffreys, or *Diaphana gemma* of Verrill, which has no plait and is much more attenuated behind. (*Dall*).

R. SPATHA Watson. Pl. 25, figs. 53, 54, 55.

Shell large, cylindrically oblong, gradually and slightly narrowing forwards, more abruptly so up the short stumpy and very blunt spire, thick, exquisitely reticulated, with a truncated and toothed pillar and a straight, slightly contracted outer lip. Sculpture: Longitudinals—the whole surface is delicately and sharply scored in the lines of growth with very fine rounded furrows parted by sharper and much narrower ridges, which are about $\frac{1}{120}$ of an inch apart. Spirals—a little stronger than the longitudinals which they cut across, are spiral lines very distinct above, one or two on the shoulder being even stronger and remote, more delicate and similar to the longitudinals in front, and in the middle very faint indeed, only sufficient to produce a satiny sheen; round the top of the whorls below the suture is a very broad shallow furrow or slight constriction bordered by a very feeble keel below, which forms a vague shoulder. Colour ivory-white. Mouth $\frac{5}{6}$ of the whole length of the shell, in shape somewhat clavate, being shortly broad in front, elongately conical throughout the most of its length, and rapidly contracted at the top. Whorls $2\frac{1}{2}$, rounded above with a very slight concave constriction below the suture, subcylindrical in the middle and rounded in front. Suture linear, impressed, and very slightly horizontally margined below. Outer lip contracted amd appressed above, so that the top of the mouth runs up to a long and very narrow point, bluntly angulated at the shoulder, below this it is straight but draws in towards the axis, in front it is patulous and well

rounded; the edge line is convex, and retreats very rapidly in front, where the shell is abruptly truncate. Top very bluntly rounded, the apex being to some extent enveloped in the succeeding whorl, which rises slightly above it. Inner lip: a thick pad of glaze, with well-defined edge, extends down the slightly convex body, and passes with gradual sweep into the twisted subconcave pillar which is truncate in front; at the top of the pillar the glaze is much thickened, and presents for a short distance two very oblique twisted parallel folds, which are parted by a small furrow; another furrow lies outside, between the exterior fold and the glaze edge. Alt. 0·3 in. diam. 0·14. Mouth, height 0·25, breadth 0·03 inch. (*Wats.*).

North of Culebra I., W. Indies, 390 fms.

Utriculus spatha Wats., J. L. S. L. xvii, p. 333; Chall. Rep. Gastr. p. 649, pl. 48, f. 7.

This exceedingly peculiar form in many respects recalls, rather than a *Utriculus*, one of the long narrow low-spired Marginellas, such as *Marginella nevillii* Jouss., or *Marginella avena* Kien. (*Wats.*).

R. mayoi Dall.

Shell solid, white, with a yellowish polished epidermis and well marked lines of growth, spiral striæ very faint and few, or none; whorls 3½–4, spire distinct, little elevated, nucleus small, rounded, not prominent, aperture long, rather wide and straight, the posterior commissure rounded, the anterior wide, the margin spirally curved showing the axis (though this is not pervious); umbilical-chink none, pillar broad, white, oblique without any trace of a plication; outer lip thin, arched forward in the middle; suture very deep; inner lip with a wash of callus. Lon. of shell, 8·3; of aperture, 7·0; max. lat. 4·6 mill. (*Dall*).

Portland, Maine, from fish stomach (Mayo).

Utriculus mayoi Dall, Blake Gastr., p. 46.

This shell recalls *Bulla turrita* Möller, but is much larger, with proportionately shorter spire, straighter sides and more width anteriorly. (*Dall*).

R. frielei Dall. Pl. 21, fig. 8.

Shell rather large, solid, polished opaque white, broader behind than before its middle; apex perforate, around which the margin of

about two turns is usually visible; this margin, formed by the rather broad ⊃-shaped posterior sinus of the aperture, resembles the notch-band of some Pleurotomidæ in that the surface is flattened, with a well-marked boundary on each side, and on this surface the successive marginal edges are often raised into scales, one fitting into another, composed of an extension of the body callus on one side and a reflection of the free margin on the other; the surface of the band varies in different specimens from nearly smooth to distinctly and regularly undulated or imbricately scaled as above mentioned; other transverse sculpture of lines of growth which are hardly visible while of spiral sculpture there is none, though, with a strong reflected light, under the microscope numerous spiral markings may be observed which are neither grooved nor raised, but are visible in most smooth spiral shells, and are probably due to growth, somewhat as are the lines commonly recognized as "lines of growth." Aperture nearly or quite as long as the shell, narrow, rounded in front, and terminating in the ⊃-shaped sinus behind; outer lip straight, sharp, thin, not incurved, rounded to join the stout columella into which it passes imperceptibly; pillar broad, short, with a thin callus which also extends along the body; shell widest about the posterior third; distinctly narrowed anteriorly. Lon. of shell and aperture (the latter occasionally a trifle less), 8·2. Max. lat. of shell (at posterior third), 4·0; at anterior third, 3·5; of aperture, 1·75; min. lat. of aperture, 0·5 mill. (*Dall*).

Off Cape San Antonio; Yucatan Strait, 640 fms.

Utriculus? frielei DALL, Bull. M. C. Z. ix, p. 104, 1881; Blake Gastr., p. 47, pl. 17, f. 4.

Utriculus leucus Watson seem to approach this species as nearly as any known form, but has sundry distinctive characters. There is no doubt, however, that there are differences of form and development of the tip of the spire in these enrolled forms, in adult individuals, as well as during the stages of one individual. It will not do, therefore, to draw the specific lines too taut on this sort of character. (*Dall*).

R. PERVIUS Dall. *Unfigured.*

Shell short, stout, truncate apically, white, polished, sculptured only with faint incremental lines; form subcylindrical, larger anteriorly, a little compressed just behind the middle; aperture long, narrow behind and rounded at the posterior commissure, where it

has a shallow rounded notch, the outer boundary of whose path is marked by the summit of a raised line; anterior part of aperture wider, not very oblique, rounded in front; outer lip straight, thin, arched forward in the middle; pillar thin, simple, with no trace of a plait; body without perceptible callus; behind the pillar a small very deep umbilical perforation; apex nearly flat, bounded by the above mentioned raised line, within which the fasciole of the notch is rounded over but does not reach the level of the line referred to; nucleus somewhat depressed, but not deeply: about three and a half whorls are visible on the apex. Max. lon. of shell 4·0; max. lat. 2·5; lat. of apex 1·5 mill. (Dall.).

West Indies (U. S. Fish Commission), *probably from near Barbados*, in about 80 fms., sand.

Utriculus pervius DALL, Blake Gastr. p. 48.

This species is remarkable for its deep though minute umbilicus and its dish-like apex. Its general form is not unlike *U. perplicatus*, but the sides are straighter and the other characters quite different. The locality is unfortunately doubtful though it was somewhere in the Antilles (Dall.).

R. OMPHALIS Mörch. *Unfigured.*

Shell subcylindrical, short, slightly contracted in the middle, with obsolete growth striæ, regular and elegantly expressed toward the spire; spiral striæ very obsolete, irregular. Spire openly umbilicated, surrounded by a white pellucid line. Aperture very narrow posteriorly, dilated anteriorly; columella straight, thick; external margin acute. Alt. nearly 4, diam. 2 mill. (*M.*).

St. Thomas (Riise).

Retusa omphalis MORCH, Malak. Bl. xxii, p. 172, 1874.

Not dissimilar from *Cylichnella bidentata*, but larger, thinner, with umbilicate spire and straight columella, etc. (*M.*)

R. SULCATA Orbigny. Pl. 23, figs. 73, 74.

Shell cylindrical, white, dilated below, thin, pellucid, longitudinally sulcate, truncated at summit and concave, the spire umbilicated. Aperture linear, suddenly dilated below.

Alt. 2, diam. 1 mill.

Cape Hatteras; West Indies, 14–31 fms.

Bulla sulcata ORB., Moll. Cuba i, p. 129, pl. 4 bis, f. 9–12.—*Utriculus* (*Retusa*) *sulcata* DALL, Blake Gastr. p. 45; Cat. Mar. Moll. S. E. U. S., p. 86.

R. CECILLII Philippi. Pl. 23, fig. 53.

Shell ovate-oblong, subcylindrical, very thin, whitish, the spire depressed-conic; sutures impressed and plicate; aperture linear, at base dilated. Alt. 5·5, diam. 2·66 lines. Whorls 4–4½. (*Phil.*)

Japan (Dkr.); *China* (Largilliert).

Bulla cècillii PH., Zeitschr. f. Mal. 1844, p. 164.—DKR., Ind. Moll. Mar. Jap. p. 164, (as *Utriculus*).

Shell almost exactly cylindrical, thin, smooth, shining; with arcuate growth-striæ, but little conspicuous, but somewhat plicated at the suture. Spire much depressed, obtuse or somewhat acute. Aperture linear, dilated below. This species corresponds to *B. jeverensis* Schroeter of the German Sea, but is thrice the size; *B. voluta* Q. & G. is narrower with very deep sutures (*Ph.*)

A. Adams gives the locality "Mexico." His description is as follows, the above figure being copied from the Thesaurus.

Shell ovately cylindrical, thin, smooth, covered with an olivaceous epidermis, longitudinally substriated; spire distinct, rather elevated, whorls five, suture corrugated; aperture narrow, anteriorly widely dilated; columella arched, simple.

Mexico (Mus. Hanley).

Bulla (*Utriculus*) *cecillii*, A. ADAMS, in Thes. Conch. ii, p. 572, pl. 120, f. 22.—*U. cecillii* SOWB., Conch. on. f. 3.

Southern and Indo-Pacific species.

R. SUCCINCTA A. Adams. *Unfigured.*

Shell cylindrical, coarctate in the middle, the vertex truncate; white, longitudinally striate throughout, transversely banded, bands pale and rather distant. Aperture linear, narrowed in the middle, dilated in front, the inner lip obsoletely plicate (*Ad.*).

Tsu-Sima, Japan, 16 fms.; *Awa-Sima*, at low water (Ad.).

Tornatina succincta AD., Ann. Mag. N. H. (3), ix, p. 154.

In form the species most resembles *T. truncata* J. Adams; but it is more elongated and much narrower, and marked with indistinct pale bands; the whorls of the spire are visible but sunken, and the parietal plica is not conspicuous (*Ad.*).

R. BORNEENSIS A. Adams. Pl. 23, fig. 46.

Shell ovate-cylindrical, smooth, subpellucid, white, covered with a ferruginous epidermis, longitudinally striated; spire distinct, flat,

whorls 4, rounded, the first mamillate, aperture narrow, dilated in front; columella long, semitortuous, umbilicus none (*Ad.*).

Borneo (A. Ad.); *Mauritius* (Möbius.)

Utriculus borneensis A. Ad., Thes. Conch. ii, p. 572, pl. 120, f. 23.—Sowb., Conch. Icon. f. 6.—v. Martens, in Möbius' Reise n. Mauritius, p. 303.

A much smaller shell than *B. cecillii*. It is narrower, more cylindrical; the aperture is more produced anteriorly; the columella is longer and straighter, and the spire is more depressed. The mud flats at the mouths of many of the rivers of Borneo are partially covered at low water with this animal; the shell is always covered, when the animal is alive, with a rust-colored epidermis (*Ad.*).

R. COMPLANATA Watson. Pl. 21, fig. 2.

Shell minute, cylindrical, truncated and flat on top, very much and obliquely truncated in front, with whorls angulated above and furrowed longitudinally and spirally, a papillary apex, a longish pillar, and a club-shaped mouth. Sculpture: Longitudinals—the furrows on the lines of growth are strong and curved. Spirals—the whole surface is scored with sharp irregular furrows parted by flat intervals of about three times their width. Color white. Mouth the full length of the shell, narrow above, oblong and roomy in front, club-shaped. Whorls 3; on the top of the shell they are rounded. Suture slightly impressed. Outer lip rises roundly, the least thing above the top; its course is straight, with a very slight concavity; its edge is prominent. Top perfectly flat, with a roundly angulated edge; the individual whorls are rounded, and are parted by a somewhat impressed suture; the central tip, which is glossy, is papillary, but depressed. Inner lip is, on the body, slightly concave in its course; the pillar is oblique, nearly straight, and is patulous. Alt. 0·05 in., diam. 0·028. Breadth of mouth at same place, 0·013 inch (*Wats.*).

West of Cape York, off southwest point of Papua, 28 fms.

Utriculus complanatus Wats., J. L. S. L. xvii, p. 335; Chall. Rep. Gastr. p. 650, pl. 48, f. 9.

This is a very small species, the solitary specimen of which is not in good condition. It is a good deal like *Utriculus truncatulus* (Brug.); but the sculpture is a very marked feature of difference, and the form is more stumpy (*Wats.*).

R. AMPHIZOSTUS Watson. Pl. 21, fig. 4.

Shell small, rather broadly cylindrical, but contracted in the middle, and broadest below the contraction, very bluntly rounded in front, longitudinally striate and very finely spiralled, with a flat but slightly depressed crown and a small papillary apex. Sculpture: Longitudinals—there are a great many small hair-like ridges and furrows on the lines of growth; they are nowhere strong, but are feeblest on the base. Spirals—the whole surface is very equally striated, with delicate shallow scratched lines parted by flat surfaces four or five times the width of the lines; there is a very slight and gradual constriction most apparent near the outer lip about the middle of the body, and in front of this the shell is slightly tumid. Color translucent white, with vague trace of spiral bands. Mouth the full length of the shell; shaped like a racket, being oval in front, long and narrow above; it is small and rounded at the top, which just rises to the crown. Whorls 4, of which only the small rounded tops are seen on the crown, where they are slightly and radiatingly ridged, the last envelopes all the others. Suture impressed and distinct. Outer lip rounded at the top where it does not rise above the crown; it runs straight and parallel to the inner lip till below the middle where it bends outwards in exact symmetry with the corresponding bend of the inner lip on the base, forming a very regular oval curve in front; the edge line is regularly curved, retreating slightly behind and in front, and advancing in the middle where the lip is contracted. Top flat, but slightly depressed, with a small papillary apex in the middle, the outer edge is roundly angulated. Inner lip straight down the body, concave on the pillar, which has a very slight twist and a narrow patulous edge, behind which is a scarcely appreciable umbilical depression; the point of the pillar projects in front clear of the sweep of the basal curve. Alt. 0·12 in., diam. 0·06. Breadth of mouth at same place, 0·02 inch (*Wats.*).

Near Cape York, N. E. Australia, 6–8 fms. (Chall.).

Utriculus amphizostus WATS., J. L. S. L. xvii, p. 336; Chall. Gastr. p, 652, pl. 48, f. 11.

This species is very like *Utriculus truncatulus* (Brug.); but that has much stronger longitudinals, no spirals, and an oblique crown, sloping down from left to right on which side the top of the mouth and outer lip rise in a rounded loop very considerably above the top of the body whorl (*Wats.*).

R. FAMELICUS Watson. Pl. 21, fig. 6.

Shell long, narrow, subconically cylindrical, with straight outlines, abruptly truncate above, with a deeply impressed papillary apex, rounded and slightly tumid in front, harshly striate above and delicately so below. Sculpture: Longitudinals—the lines of growth are very slight, but round the top of the shell is a coronal of folds forming ridges and furrows of about equal strength; these extend over the top and into the hollow crown. Spirals—round the top, harshly scoring the coronal, are four or five deep, but not broad, sharp cut furrows, parted by flat surfaces of about twice their breadth; below these to a fourth of the length, there are distant furrows so obsolete as to be almost invisible; below this the whole surface is superficially scratched with delicate sharp-cut fretted furrows parted by broadish flat intervals. Color translucent white. Mouth the entire length of the shell, being considerably produced posteriorly, where it is slightly enlarged; in the middle it is narrow, the two sides being almost perfectly parallel, in front it is elongately oval; in its entire shape it resembles a spoon. Whorls 4, but the earlier ones are so deeply sunken, and the hole in the crown (where alone they are visible) is so small, that it is difficult to count them; the apex is papillary. Suture slight. Outer lip rises straight from the crown, with a slight inclination in towards the center, is narrowly rounded above, and advances straight for about two-thirds of the shell's length, at which point it is slightly expanded and then becomes somewhat patulous; it sweeps rather freely round to join the pillar. Top small, oblique, harshly radiatingly striate and deeply narrowly impressed. Inner lip long and straight, slightly convex in front, oblique and slightly concave on the pillar which is bluntly toothed in front, and has a very narrow scarce patulous prominent edge with a minute furrow behind it. Alt. 0·18 in., diam. 0·06. Mouth breadth at same place, 0·019 inch (*Wats.*).

Levuka, Fiji, 12 fms. (Challenger).

Utriculus famelicus WATSON, J. L. S. L. xvii, p. 338; Chall. Rep. Gastr. p. 653, pl. 49, f. 1.

This species, whose thin and famished look suggested the name chosen, belongs to the group of which the Mediterranean *Utriculus striatula* (Forbes) may be taken as a type, though in that species the features attributed to the subgenus *Sao* (of *Cylichna*) are much more strongly developed. Compared to this species of the Chal-

lenger, *Cylichna fijiensis* E. A. Smith is broader, not squarely truncate above, and not so plicate around the top of the body. *Utriculus phiala* A. Adams, from Japan, is not nearly so long and narrow, and is more cylindrical. *Cylichna decussata* A. Adams, which is like in sculpture, is shorter, less cylindrical, and the outer lip rises much higher behind. *Cylichna pyramidata* A. Adams, which is puckered above, is much less cylindrical and is smooth in the body.

R. SIMILLIMA Watson. Pl. 21, figs. 9, 10.

Shell small, short, truncately conical, with straightish outlines, a perforated crown, and a small papillary apex, rounded and tumid in front. Sculpture: Longitudinals—the lines of growth are very slight; but round the top of the shell is a coronal of delicate folds forming ridges and furrows of about equal strength; these extend over the top and into the perforation of the crown. Spirals—round the top is a slight but marked constriction; above this the top converges, and is finely scored with small close-set furrows; the rest of the shell is superficially scratched with delicate, sharp-cut, fretted, remote furrows parted by flat surfaces; on the base the furrows are closer and coarser, and the intervals rounded. Color translucent white. Mouth the entire length of the shell, being considerably produced posteriorly, where it is enlarged; in the middle it is narrow and slightly bent, in front it is large and oval. Whorls 3 to 4; the apex is papillary but very small and so deeply immersed as to be doubtfully visible. Suture very difficult to distinguish, but apparently impressed. Outer lip rises from the inner side of the perforation and bends in over it so as partially to cover it; it arches freely round and is not at all emarginate; it runs pretty straight forward for about three-fifths of its length, at this point it is slightly constricted and contracted, but immediately bends to the right and curves very regularly round the base, where it is patulous. Top contracted, rounded, oblique, harshly radiatingly striate, and deeply narrowly impressed. Inner lip convex, tumid in front, oblique and slightly concave on the pillar, which is feebly toothed, and has a very narrow, scarcely patulous, prominent edge, with a minute furrow behind it. Alt. 0·1 in., diam. 0·047. Mouth breadth at same place 0·024 inch (*Wats.*).

Torres Straits and Flinder's Passage, N. E. Australia, 3–11 fms.

Utriculus simillimus WATS., J. L. S. L. xvii, p. 340; Chall. Gastr. p. 654, pl. 49, f. 2.

This species exceedingly resembles the young of *Utriculus famelicus* Watson, but is very much broader in proportion to its length. *Cylichna fijiensis* E. A. Smith is much larger and slimmer (*Wats.*).

R. EUMICRA Crosse. Pl. 23, figs. 43, 44.

Shell imperforate, small, thin, subcylindrical, shining, smooth, subpellucid, white; spire nearly flat, the apex strongly projecting; whorls 3½, the last large, nearly as long as the whole shell; aperture narrow, enlarged toward the base. Alt. 4½, diam. 2 mill. (*C. & F.*).

Spencers Gulf, S. Australia.

Bulla eumicra CROSSE, Journ. de Conchyl. 1865, p. 40, pl. 2, f. 7. —*Utriculus eumicrus* ANG., P. Z. S. 1865, p. 188.

R. APICULATA Tate. Pl. 23, fig. 45.

Similar to *U. eumicrus* Crosse, but distinguishable by its sunken spire, the papillary apex of which is exserted beyond the level of the body whorl. The anterior extremity of the shell is more gradually tapering, and the shoulder of the body whorl is less abruptly arched, consequently *U. apiculatus* is more fusiform than its ally. It is also much larger.

King George's Sound, S. W. Australia.

Utriculus apiculatus TATE, Trans. and Proc. and Rep. Philos. Soc. of Adelaide, for 1878–9, p. 138, pl. 5, f. 3.

R. ORYCTUS Watson. Pl. 21, fig. 5.

Shell subcylindrically oblong, tumid below the middle and rounded in front, obsoletely striate in the lines of growth, truncate above, when the crown is sharply angulately edged and excavated with a papillary apex. Sculpture: Longitudinals—the ordinary ridges and furrows in the lines of growth are feeble, except on the crown, where the old lip edge scars are strongish, close and hair-like. Spirals—none, except that round the edge of the crown there runs a sharp angulation in continuation of the outer lip. Color ivory-white, somewhat streaked longitudinally. Mouth a little longer than the body, and at the top, to a small extent, enlarged, slightly curved on the inner side, and there in front gibbous; on the outer side it is nearly straight. Whorls 3; the last encircles all the rest, which only appear on the crown, where each rises above its predecessor in a round-faced curve; the first is papillary and immersed, the last rises above on the margin in a sharp edge and is

a little tumid in front. Suture slightly impressed. Outer lip rounded and cut off backwards above, angulated at its upper outer corner, straight with a slight medial contraction, rounded and patulous in front; its edge line is very regularly curved. Top deeply excavated, with a sharp edge. Inner lip: there is a very thin glaze; the line across the body is much curved, the narrowing forward of the body beginning early and being considerable; the pillar is very oblique, subtruncate, very bluntly and faintly toothed, with a narrow expanded sharpish bordered edge, and an almost imperceptible umbilical chink behind it. Alt. 0·13 in., diam. 0·07. Mouth breadth at same place 0·01 inch (*Wats.*).

Ascension Island, 420 fms. (Challenger).

Utriculus oryctus Wats., J. L. S. L. xvii, p. 337; Chall. Gastr. p. 653, pl. 48, f. 12.

The very sharp outer rim of the crown in this species is characteristic. The species slightly resembles a large and stumpy *Cylichna umbilicata* (Mont.), but is posteriorly squarer and more truncate, the whole top is different, the line of the pillar is straight in its obliquity, not roundly hollowed, and there is no spiral sculpture. (*Wats.*).

R. antarctica Pfeffer. Pl. 23, fig. 47.

Shell very thin, whitish, cylindrical-ovate, the width five-ninths the altitude; spire elevated, the vertex oblique. Whorls 3, separarated by a channelled suture, the last whorl three-fourths the length of the shell, tapering toward the base. Aperture narrower above, much dilated below, the outer lip slightly flexuous, subauriculate above, obtusely rounded below; columella strongly arcuate, without fold. Alt. 2·7 mill. (*Pffr.*).

South Georgia.

Utriculus antarcticus Pfr., Jahrb. Hamburgischen Wissensch. Anstalten, iii, p. 109, pl. 3, f. 5, 1886.

Described from a single specimen found among roots of Hydroids. It is excessively fragile. The attenuation of the body-whorl below is its principal peculiarity.

R. involuta Philippi. *Unfigured.*

Shell small, cylindrical, transversely striated above and below, milk-white; apex retuse and with a profound pit like an umbilicus; aperture linear, very narrow, suddenly dilated at the base, very ob-

tusely plicate; external-basal angle of aperture very prominent; lip thin, contracted in the middle. Alt. 3½, diam. 1⅓ lines (*Ph.*).

China (Largilliert).

Bulla involuta PHIL., Zeitschr. f. Mal., 1851, p. 64.

Has much affinity to *B. convoluta* Brocchi, but shorter, striated above and below, and base of the aperture suddenly dilated (*Ph.*). The generic position is very doubtful. Perhaps it is a *Cylichna*.

R. SEMINULUM Philippi. *Unfigured.*

Shell small, subcylindrical, a little attenuated toward the base, very smooth, milk-white; spire short, obtuse, distinct; aperture linear, a little dilated at the base, obsoletely folded. Alt. 1½, diam. ¾ lines (*Ph.*).

Manila.

Bulla seminulum PHIL., Zeitschr. f. Mal., 1851, p. 64.

This species is like *B. obstricta* Gld., *B. obtusa* Mont, but differs in having the base of the shell attenuated and the aperture much narrower (*Ph.*).

Subgenus PYRUNCULUS Pilsbry, 1894.

Sao H. & A. ADAMS, Gen. Rec. Moll., ii, p. 21, Sept., 1854, type *S. pyriformis* A. Ad.—*Conf.* SMITH, Ann. Mag. Nat. Hist. (4), ix, p. 354, 1872.

Not *Sao* Billberg, Enum. Ins., p. 135, 1820 (*Crustacea*), nor *Sao* Barrande, 1846 (*Trilobita*); nor *Sao* Kölliker, 1853 (*Siphonophora, Forskaliidæ*).

Shell pyriform, wide below, narrowed above, the aperture as long as the shell, and of similar shape, columella thickened. Spire depressed and rather shallowly or deeply umbilicated. Surface generally with some basal spiral striæ. Soft parts unknown.

Adams' name *Sao* being thrice preoccupied, has been changed to *Pyrunculus*. The systematic position of the species cannot be definitely settled until the soft parts are known—Adams considering the group a subgenus of *Atys*, Smith placing it under *Cylichna*, while Fischer has *Sao* as a subgenus of *Tornatina*. The characters of the shells' apex seem more like *Retusa* than *Cylichna*, so that it may be advisable to retain it as a section of that genus for the present.

R. PYRIFORMIS A. Adams. Pl. 33, fig. 68.

Shell small, ovate, greatly dilated at the base, gibbose, shining, white, smooth, pellucid, apex truncated, obsoletely longitudinally

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sulcated, above and below transversely striated; spire not visible, apex slightly umbilicated; aperture narrowed above and greatly dilated below; outer lip acutely truncated above; columella reflected, rather callous in the middle; umbilicus deep (*Ad.*).

China Sea (Cuming).

Bulla (*Atys*) *pyriformis* Ad., Thes. Conch., ii, p. 589, pl. 125, f. 128.—*Sao pyriformis* Ad., Gen. Rec. Moll., ii, p. 21.

R. nitida A. Adams. Pl. 33, fig. 65.

Shell very small, obovate, white, opaque, shining, dilated at the base, apex rounded and deeply umbilicated, transversely striated above and below; aperture produced above and narrow, inferiorly dilated; columella simple, reflected; umbilicus small; outer lip rounded superiorly and arched (*Ad.*).

Shores of Borneo (Cuming).

Bulla (*Atys*) *nitida* Ad., Thes. Conch., ii, p. 589, pl. 125, f. 127.

R. lagenula A. Adams. *Unfigured.*

Shell cylindrical-pyramidal, swollen below, the umbilical region impressed, transversely striated, the striæ rather distant; dull white; apex perforated; aperture linear, much dilated below; inner lip short, thickened; outer lip straight, posteriorly produced, anteriorly rounded and arcuate (*Ad.*).

Gulf of Pe-chili, 5 fms. (*Ad.*)

Sao lagenula Ad., Ann. Mag. Nat. Hist. (3), viii, p. 139.

R. folliculus A. Adams. *Unfigured.*

Shell ovate, umbilicate, rather solid; base dilated, gibbous; smooth, transversely striated posteriorly; apex profoundly perforate. Aperture dilated in front, narrow behind; inner lip thickened; outer lip strongly produced behind and acuminately angular (*Ad.*).

Tabu-Sima, Japan, 25 fms. (Ad.).

Sao folliculus Ad., Ann. Mag. N. H. (3), ix, p. 160.

The only species resembling this is *S. pyriformis* A. Ad., from the China Sea; but that species is much more ventricose, and more attenuated posteriorly (*Ad*).

R. phiala A. Adams. *Unfigured.*

Shell cylindrical-pyramidal, attenuated anteriorly [?], subconstricted below the summit, rimate, transversely striated above and below; vertex profoundly perforated; aperture linear, coarctate

behind, dilated in front; inner lip straight, elongated, simple; outer lip strongly produced behind (*Ad.*).

Mino-Sima, Japan, 63 fms.

Sao phiala Ad., Ann. Mag. N. H. (3), ix, p. 160.

The peculiar contraction at the anterior part of the body-whorl just below the apex, the produced outer lip, and the straight simple inner lip are the chief peculiarities of this species (*Ad.*).

R. elliptica A. Adams. *Unfigured.*

Shell small, white, thin, elongate-ovate, subdilated in front, longitudinally streaked, transversely striated above and below; aperture linear, dilated below; inner lip straight calloused in the middle; outer lip with arcuate margin, posteriorly produced, rounded (*Ad.*).

Tsu-Sima, Japan, 16 fms.

Sao elliptica A. Ad., Ann. Mag. N. H. (3), ix, p. 160.

A small white, longitudinally strigose, ovate species, differing in form and appearance from any other of the group (*Ad.*).

R. pellyi Smith. *Unfigured.*

Shell pyriform, the base double as wide as the top; white, transversely, distantly striated at base; vertex umbilicated, surrounded outside by a lira (decussated by curved longitudinal, rather evanescent striæ). Aperture narrow above, produced above the vertex, greatly dilated below. Columella short, thickened; umbilical region perforated. Alt. 4, diam. 2 mill. (*S.*).

Persian Gulf (Col. Pelly).

Cylichna (*Sao*) *pellyi* E. A. Smith, Ann. Mag. Nat. Hist. (4), ix, p. 354 (May, 1872).

Considerably larger than *C. nitida* A. Ad., and proportionately narrower towards the upper end.

R. obesiuscula Brugnone. Pl. 23, figs. 60, 61.

Shell 5 mill. high, 3 mill. wide, subconic-oval, truncated obliquely above, shining and smooth, with fine and numerous striæ of growth, stronger toward the summit; last whorl ventricose. Aperture narrow and linear above, below enlarged, rounded and everted a little to the left, the outer lip gently curved and projecting a little above the apex; columella rather straight, inclined to the left, bending outwards, and with an obscure fold in the middle. The apex with a narrow, funnel-shaped, sharp edged umbilicus; base with a small umbilical slit partly covered by the reflection of the columella.

Cylichna obesiuscula Brugnone, Bull. Soc. Mal. Ital., III, p. 39, pl. i, fig. 7, 1877.—*Diaphana conulus* Verrill, Proc. U. S. Nat. Mus., III, p. 382, 1880; Trans. Conn. Acad., V, p. 543, pl. lviii, fig. 25, 1882; VI, p. 273, 1884.—*Retusa ? obesiuscula* Brugn., Dall, Blake Gastr., p. 49.

Pliocene of Messina, (Seguenza); *of Palermo* (Brugnone); *U. S. Fish Commission Stations* 870, 949, 2595, 2602 *and* 2614, in 63–168 fms., living in about 100 fms.

This species is quite distinct from *Bulla conica* or *conulus* of Deshayes, Wood, Sars, etc., from *C. hœrnesi* and *C. ovata*, with all of which it has been confounded by various authors, especially Jeffreys. Professor Verrill in referring to it noted the discrepancies. (*Dall*).

R. ovata Jeffreys. Pl. 30, fig. 11.

"Larger (than *Cylichna umbilicata*) narrower at the apex, and conical; the upper angle of the outer lip is higher and more projecting" (Jeffr.).

Cylichna ovata Jeffreys, Rep. Brit. Assoc., 1870, Porc. Exp., p. 156; Ann. Mag. Nat. Hist., 5th ser., X, p. 34, 1882.—Watson, Chall. Rep., p. 664, pl. xlix, fig. 9, 1885.—*Utriculus conulus* G. O. Sars, Moll. Reg. Arct. Norv., p. 287, pl. 17, fig. 17, 1878.—*Cylichna umbilicata* var. *conulus* Jeffr., Brit. Conch., IV, p. 414; V, p. 223. Not *Bulla conulus* Deshayes, *Cylichna conulus* of Weinkauff, or *Bulla conulus* of Searles Wood.—*Retusa ? ovata* Dall, Blake Gastr., p. 49.

North Atlantic (Porcupine and Triton Expeditions); *Bay of Biscay* (Travailleur Expedition); *Azores* (Josephine, Porcupine and Challenger Expeditions); *West Indies*; *off Pernambuco* (Challenger Expedition); *Straits of Florida*, 150–465 fms. (Dr. Rush); *East Coast of North America*, 124–400 fms. (U. S. Fish Commission); range 100–1000 fms. over a muddy bottom in all parts of the North Atlantic, with temperatures from 40° to 62° F.

R. cælata Bush. Pl. 23, fig. 69.

Shell rather thick, opaque white, with a slightly lustrous surface of moderate size, somewhat conical in shape, with a truncated tip and an elongated tapering base. Spire concealed within a very deep pit; the two or three whorls are distinctly visible in an end view and are crossed by numerous delicate, little curved riblets which curve over the top of the body-whorl extending down a short distance, and gradually blend with the flexuous lines of growth.

Commencing about the middle of the whorl and covering the base there are numerous, fine, punctate, spiral lines, very much crowded anteriorly. Aperture very narrow, expanded anteriorly; outer lip a little produced at the top, bending round somewhat abruptly, then following the outline of the body-whorl, and joining the inner lip in a regular curve; inner lip much thickened at its base, with a minute umbilical chink behind it. Color yellowish-white. (*Bush*).

Alt. 3, diam. 1·5 mill. (*Bush*).

Cape Hatteras, N. C., rare in 15–43 fms. (U .S. F. C.), *Fernandina Florida.*

Cylichna cælata Bush, Trans. Conn. Acad., vi, p. 468, pl. 45, f. 15.—*Retusa cælata* Dall, Blake Gastr., p. 45.

Genus VOLVULA A. Adams, 1850.

Volvula A. Ad. in Sowerby's Thesaurus Conchyliorum, ii, p. 558. Not *Volvulus* Oken, Lehrb. Naturg., 1815 (Moll.), nor of Brullé, Hist. Nat. Ins., 1835, (Coleoptera).—*Volvulella* R. B. Newton, Syst. List Edwards Coll. Brit. Oligocene and Eocene Moll., p. 268, 1891.—?? *R hizorus* Montf., Conch. Syst., ii, p. 338, 1810.

Shell external, subcylindrical or long-oval, tapering at both ends, the body-whorl more or less produced in a beak or spine above. Spire concealed; aperture as long as the shell, very narrow, the outer lip simple, produced above; columella somewhat thickened, with the trace of a fold. Type *V. acuminata.*

Animal with a squarish frontal disc, produced in two processes behind, as in *Retusa,* in front of which are the eyes. No epipodial lobes; foot shorter than the shell. (pl. 60, figs. 9, 10, *V. acuminata*).

The shell differs from *Tornatina* and *Retusa* in its attenuation at the ends, the upper extremity of the body-whorl being produced into a sort of spine in the typical species. The animal closely resembles *Retusa* in external features, but it is not known whether radula-teeth are present or not.

The generic term *Volvula* is not preoccupied. The names *Volvulus* of Oken, and *Volvulus* of Brullé seem to be sufficiently distinct in form to preclude any danger of confusion with *Volvula.*

V. smithii Pilsbry, n. n. Pl. 26, fig. 65.

Shell minute, elongate-ovate, rostrate above, polished, white, transversely striated at both ends, smooth in the middle; aperture

narrow above, dilated below ; columella thick. Alt. 5, diam. 3 mill. (*S.*).

Whydah, W. Africa.

Volvula cylindrica E. A. SMITH, P. Z. S., 1871, p. 738, pl. 75, f. 29. Not *V. cylindrica* Cpr.

Peculiar for the beaked apex and the (about 12) spiral striæ at the upper and lower portions. (*S.*).

V. ACUMINATA Bruguière. Pl. 26, figs. 61, 62 ; pl. 60, figs. 9, 10.

Shell oval-cylindrical, elongated, about three times as high as wide, convoluted, acuminate at the summit, rounded at base, the spire concealed. Thin, translucent and shining, with very weak spiral striæ toward the summit and the base. Aperture very narrow, nearly linear, wider at base ; lip simple and sharp, flexuous, rounded at base ; columellar margin rounded. Columella visibly twisted, arcuate and thickened. Color hyaline white. Alt. 2·7, diam. 1 mill. ; sometimes larger.

Mediterranean and Adriatic Seas, Atlantic from Norway to the Gulf of Gascony, laminarian and coralline zones ; *Gulf of Suez* (Cooke).

Bulla acuminata BRUG., Encycl. Méth., i, p. 376, 1792.—PHIL., Enum. Moll, Sicil. i, p. 122, pl. 8, f. 18.—*Volvula acuminata* A. AD., Thes. Conch., ii, p. 596, pl. 125, f. 152.—BUQ. DAUTZ & DOLLF., Moll. Rouss., p. 534, pl. 64, f. 4, 5.—COOKE, Ann. Mag. (5), xvii, p. 130.—M. SARS, Bidrag til Kundskab om Christianiafjordens Fauna, 1870, p. 62, pl. 11, f. 19–22 (living animal).—*Ovula acuminata* FORBES & HANLEY, Hist. Brit. Moll., iii, p. 500, pl. 164B, f. 3.—*Cylichna acuminata* JEFFR., Brit. Conch., iv, p. 411; v, p. 222, pl. 93, f. 1 ; Ann. Mag. Nat. Hist. (4), v, p. 448.—*Bulla fucicola* CHIEREGHINI, BRUSINA, Bib. Malàc., ii, Ipsa Chier.C onch., p. 117, 1870, (no description).

There can be no doubt that the slender *Volvula* of the Mediterranean is the type of Bruguière's description ; his measurements corresponding closely to specimens, which are *about three times as long as wide.* His reference to Plancus (De Conchis minus notis, etc.) is less happy, for the figures cited can hardly be believed to be this shell. Whether *V. oxytata* Bush and *V. persimilis* Mörch are the same I do not know, as I have not seen specimens of them ; but there is nothing in the descriptions, so far as I can see, to distinguish the American forms from the Mediterranean. Chiereghini's *B.*

fucicola is a (posthumous) nude name, absolutely unknown except for Brusina's statement that it is the *B. acuminata* Brug.

Var. BREVIS Pilsbry. Pl. 60, fig. 11.

Shell regularly spindle-shaped, or forming an elongated oval which is pointed above and broad below; it is thin, almost transparent, and glossy; sculpture slight spiral striæ at each end, and very faint microscopic lines in the same direction on the intermediate space; the striæ near the apex are fewer and more remote than those near the base; epidermis inconspicuous; color, clear white. Mouth very long, commencing at the top in a short and slightly recurved spike, and gradually widening towards the base, where it is expanded and rounded; outer lip flexuous, with a sharp edge; inner lip consisting of a mere film on the upper part and in the middle, but thickened and reflected at the base, so as to give the pillar the appearance of having a short fold; pillar twisted, and bending a little to the left. (*Jeffr.*).

Alt. 3·75, diam. 1·87 mill.

Northern Europe; *Mediterranean.*

This form is far stumpier than the typical *V. acuminata*, the diameter being nearly one-half the altitude. The references to Forbes and Hanley, Jeffreys (Brit. Conch.), and Adams in the above synonymy, belong to this form.

V. OXYTATA Bush. Pl. 26, fig. 63.

Shell rather small, somewhat cylindrical, with a sharp, spike-like apex and a tapering, rounded, anterior end, rather thin, semi-transparent, somewhat lustrous, with four or five very fine, indistinct, punctate spiral lines on each end, and very indistinct, microscopic striæ on the intervening surface. Aperture long, very narrow, expanded anteriorly; outer lip thin, following the curvature of the body whorl to just below the middle where it continues in a straight line and joins the inner lip in a broad curve; inner lip very thin, slightly reflected anteriorly over a slight umbilical chink. Color bluish-white under a pale yellow epidermis. Length of one of the largest specimens 4, breadth, 1·5 mill. (*Bush*).

East coast of the United States, from Hatteras to Cuba, 5–63 fms.

V. oxytata BUSH, Trans. Conn. Acad. vi, p. 468, pl. 45, f. 12, 1885.—DALL, Blake Rep. Gastr. p. 50.—? *V. persimilis* MORCH, Malak. Bl. xxii, p. 179, 1875.

Dall gives the following notes upon this form; but his Mediterranean *oxytata* are evidently typical *acuminata*, and the stout form from northern Europe is what I have called var. *brevis*: "In examining the Jeffreys collection I find this species represented from the Mediterranean from various collectors, and from Adventure Bank, Porcupine Expedition. The British and all the northern specimens, and one Mediterranean lot, are of another species, shorter and stouter, which I take to be the genuine *acuminata* of Bruguière. It in its turn differs somewhat from the Crag fossil which has been called by the same name, but perhaps not specifically. I have not seen any specimen of Mörch's shell authentically identified, but his comparative remarks render it highly probable that he had the *V. oxytata* in view."

Volvula persimilis Mörch is referred to *V. oxytata* by Dall, with a question mark. If identical, it has priority. The original description here follows:

V. persimilis Mörch. Differs from *V. angustata* A. Ad. in the shell being very subtly spirally striated, hardly visible under a lens; more solid; columella quite oblique, with thick straight fold. Differs from *V. acuta* in the subcylindrical shell.

Alt. 4½, diam. 1¾ mill.

V. ACUTA Orbigny. Pl. 60, figs. 12, 13.

Shell oblong, attenuated in front and behind, thin, white, smooth, transversely striated in front, acute behind, not perforated, transversely and longitudinally striated; aperture narrow, sinuous, suddenly dilated in front; columella subacute.

Alt. 2, diam. ·75 mill. (*Orb.*).

West Indies, north to Hatteras.

Bulla acuta ORB., Moll. Cuba, i, p. 126, pl. 4, f. 17–20.—*Volvula acuta* DALL, Blake Gastr., p. 50.—*Volvula recta* MORCH (not Orb.), Malak. Bl. xxii, p. 179.—? *Volvula minuta* BUSH, Trans. Conn. Acad. vi, p. 469, pl. 45, f. 11, 1885.

This species, when young, seems to me indistinguishable from *V. minuta* Bush, so far as the shells are concerned. I have not seen the soft parts. Northern specimens are a little yellower and more earthy than those from the Antilles, as in the case of many other species having a wide geographical range. Miss Bush's figure is

more ovate than that of Orbigny, and I find specimens agreeing with both figures in form, with others which appear more or less intermediate. This species differs from *V. acuminata* Brug, in being one quarter shorter with the same width, in having a well marked umbilical chink, and an apical process averaging shorter in specimens of the same size. (*Dall*).

The *V. minuta* of Miss Bush, which Dall believes identical with *acuta*, is described as follows:

V. minuta (pl. 26, fig. 57),

Shell very small, spindle-shaped, thin, semi-transparent, white, destitute of sculpture with the exception of three or four very indistinct, punctate, spiral lines on the base. Aperture very narrow, gradually expanding anteriorly from about the middle, with a regularly curved outer lip. Columella with a slight twist or fold, with a very small umbilical chink behind it. Epidermis indistinct. Length of the largest specimen, 2·5, breadth, 1 mill.

V. BUSHII Dall. *Unfigured.*

This species is stouter, and its posterior process more acutely pointed than in *V. acuta;* its posterior end is more inflated and blunt than in *V. acuta* or *acuminata*, and the little sharp spine rises more abruptly from this dome. The anterior part of the shell is somewhat narrower than the posterior part, with very straight sides and columella, toward which it is evenly rounded in front. There is a long chink behind the pillar, a faint wash of callus on the body, and fine microscopic spiral striæ over the polished surface. The color is greenish-white of a cretaceous quality. The columella is slightly reflected, but not twisted. Lon. 4·6; lat. 2·3 mill. (*Dall*).

Station 2602, 36 *miles S.* ½ *W. from Cape Hatteras, N. C.*, in 124 fms., sand, (U. S. Fish Commission).

V. bushii DALL, Blake Gastr., p. 51.

V. ASPINOSA Dall. *Unfigured.*

Shell white or yellowish, opaque, the young translucent, rather stout, ovate, the aperture as long as the shell, very narrow behind, wider in front, the outer lip sharp-edged, thickened inside, evenly rounded to both extremities, its middle part nearly straight, the left or opposite side of the shell much more arched than the right side; surface with well-marked incremental lines, numerous small microscopic striæ a little stronger toward the extremities; columella thick,

short, straight, with a very minute chink behind it covered mostly by callus; apex dome like, with a small rising in the center, which in the most perfect and especially young specimens is pointed; callus on the body narrow, but well marked. Lon. 4·0; lat. 2·0 mill. (*Dall*).

Off the North Carolina coast, in 18–168 fms.; *Straits of Florida*, 150–200 fms., (Dr. Rush).

V. aspinosa DALL, Blake Gastr., p. 51.

This very interesting species nearly bridges the gap between typical *Volvula* and *Cylichna*. Many of the worn or unfinished specimens show hardly a trace of an apical process; with the best developed ones it is only a raised point barely as high as the elevation of the outer lip beyond the apex, and never a spine as in the other species. There is something about its form and facies, however, which indicates its relationship even when the point is absent. Apart from the spine it is perhaps nearer *V. Bushii* than any of the others, but it is more cylindrical, smaller, and has a narrower aperture. The shell seems unusually heavy for its small size when a perfectly mature specimen is examined. (*Dall*).

V. PAUPERCULA Watson. Pl. 26, figs. 58, 59.

Shell small, cylindrically oblong, with a short, blunt, but pointed top, white, faintly spiralled. Sculpture: Longitudinals—there are fine close-set lines of growth. Spirals—the whole shell is scored with fine, shallow, remote, scarcely fretted furrows. Colour ivory-white. Mouth arched, narrow above and throughout the greater part of its length, but widening in front, where the body of the shell contracts on the base; above, it rises beyond the top of the body, and in front goes slightly beyond the point of the pillar. Outer lip is gently curved in the middle, with a quick bend at either end; its edge seems to be nearly level, but emarginate in front. Top contracts rather quickly to a small central tip. Inner lip: a pretty distinct glaze covers the body; in front of this the narrow pillar projects somewhat obliquely, with a slight twist and prominent edge, and is rather abruptly cut off at the point; behind it lies a small furrow running up into a minute umbilical chink. Alt. 0·062 in. diam. 0·03. Mouth, breadth at same place, 0·008 inch. (*Wats.*).

North of Culebra I., West Indies, 390 fms.

Cylichna (*Volvula*) *paupercula* WATS., Chall. Rep., p. 669, pl. 50, f. 5.

The *Volvula acuta* d'Orb. a Cuban species, is much sharper and more hunchy. *Volvula angustata* A. Adams, is more cylindrical and less stumpily pointed above. (*Wats.*).

(*West-American species.*)

V. CYLINDRICA Carpenter. *Unfigured.*

Shell cylindrical, white, shining, encircled by distant spiral striæ; flattened in the middle, the margins nearly parallel, rather effuse below, suddenly narrowed behind; canal very short; lip acute; inner lip indistinct; columellar fold small, very sloping.

Alt. ·17, diam. ·07 in. (*Cpr.*).

Sta. Barbara, California.

Volvula cylindrica CPR., Ann. Mag. Nat. Hist. (3), xv, p. 179 (March, 1865); Moll. Western N. A., Smiths. Misc. Coll. no. 252, pp. 23, 133, 281.

(*Indo-Pacific, Japanese and Australian species*).

V. EBURNEA A. Adams. Pl. 26, fig. 66.

Shell ovately cylindrical, white, smooth, solid, shining, inferiorly transversely striated, beaked at both ends; aperture narrow posteriorly, dilated anteriorly; outer lip posteriorly inflexed; inner lip callous; umbilicus none. (*Ad.*).

China Sea (Cuming).

B. (*Volvula*) *eburnea* AD., Thes. Conch. ii, p. 597, pl. 125, f. 155.

V. STRIATULA A. Adams. Pl. 26, fig. 64.

Shell small, ovately cylindrical, beaked at both ends, entirely transversely striated; spire concealed; aperture linear, anteriorly slightly dilated; outer lip straight, slightly inflexed in the middle; inner lip strongly twisted, with a single plait. (*Ad.*).

China Seas (Cuming).

B. (*Volvula*) *striatula* AD., Thes. ii, p. 597, pl. 125, f. 156.

V. OPALINA A. Adams. *Unfigured.*

Shell elongate-oval, rimate, white, semipellucid, smooth, shining, obsoletely transversely striated in front; mucro short, produced (with the lip) in an angle; aperture narrow, inner lip thin, oblique, incurved; outer lip regularly arcuate. (*Ad.*, Ann. Mag. N. H. (3), ix, p. 154, 1862).

Mino-Sima, Japan, 63 fms.

V. SPECTABILIS A. Adams. *Unfigured.*

Shell elongate-oval, acuminate behind, rounded in front; apical mucro short, not produced; rather thin, white, shining, most minutely transversely striated. Aperture moderate; inner lip thin, elongated, scarcely flexuous; outer lip regularly arcuate. (*Ad., l. c.*, p. 154).

Tabu-Sima, Japan, 25 fms.

V. CYLINDRELLA A. Adams. *Unfigured.*

Shell cylindric-ovate, obtuse at both ends, transversely striated throughout, the striæ close; summit short, acute, not produced; aperture linear; inner lip subtortuous; outer lip with somewhat straightened margin. (*A. Ad., t. c.*, p. 155).

Mino-Sima, Japan, 63 fms.

V. OVULINA A. Adams. *Unfigured.*

Shell elongate-oval, subventricose, transversely striated throughout, umbilicated, somewhat swollen in front, mucro at the summit small, acute, produced (with the lip) in an angle; aperture wide; inner lip tortuous, elongated, widely reflexed in front; outer lip regularly arcuate. (*Ad., t. c.*, p. 155).

Mino-Sima, Japan, 63 fms.

V. RADIOLA A. Adams. *Unfigured.*

Shell subcylindrical, acuminate at both ends, the mucro of the summit produced, acute; white, opaque, transversely striated throughout, the striæ distant; aperture linear, dilated in front; inner lip oblique, straight, somewhat thickened; outer lip with straight margin. (*Ad., t. c.*, p. 155).

Tabu Sima, Japan, 25 fms.

V. ATTENUATA A. Adams. *Unfigured.*

Shell ovate-cylindrical, narrowed at both ends, transversely striated throughout, the striæ distant; mucro acute, produced. Aperture linear, slightly dilated in front; inner lip subtortuous, oblique; outer lip with subarcuate margin. (*Ad., t. c.*, p. 155).

Tsu-Sima, Japan, 26 fms.

V. ANGUSTATA A. Adams. Pl. 26, fig. 67.

Shell cylindrical, beaked at both ends, smooth, shining white, longitudinally substriated; spire concealed; aperture linear, nar-

rowed in the middle, produced above, dilated below, outer lip contracted in the middle; inner lip with a single fold. (*Ad.*).

Cagayan, Mindanao, 25 fms. (Cuming); *Endermo Harbor, Japan*, 4–7 fms. (Smith); *Off Katow, New Guinea*, 8 fms. (Brazier).

B. (*Volvula*) *angustata* Ad., Thes. Conch. ii, p. 596, pl. 125, f. 153.—Braz., P. L. S. N. S. W., ii, p. 83.—Smith, Ann. Mag. N. H. (4), xvi, p. 114.

V. rostrata A. Adams. Pl. 26, fig. 60.

Shell elongately oval, white, pellucid, beaked at both ends, longitudinally substriated, transversely (under the lens) very minutely striated; aperture narrow, linear; outer lip equally arched; columella tortuous, with a single plait. (*Ad.*).

Port Lincoln, Australia.

B. (*Volvula*) *rostrata* A. Ad., Thes. Conch. ii, p. 596, pl. 125, f. 154.

V. sulcata Watson. Pl. 26, fig. 56.

Shell oblong, very symmetrically curved, bluntly pointed above, and still more bluntly in front, white, very faintly spiralled, but with the center part of the body plain. Sculpture: Longitudinals —there are very slight lines of growth. Spirals—at the lower end of the shell there are about ten very slight fretted spiral furrows; those above are rather sparse and irregular, those toward the point are crowded and feeble; the larger part of the shell is plain, while above are a few spirals still feebler than those in front. Colour translucent white. Mouth arched; about the middle the arch is flattened and narrowed, broadening a very little above and somewhat more in front; above, it rises bluntly beyond the top of the body, and in front it just passes the point of the pillar. Outer lip is very little curved in the middle, but bends in toward the axis at either end; its edge retreats a little above, but only very slightly in front. Top is bluntly and roundly pointed. Inner lip: there is a small transparent pointed pad where the outer lip rises from the tip, the curve of the body is regular, but just at the top of the pillar is a slight contraction; the pillar, which has a very faint tooth at its base is slightly oblique, and markedly twisted out to the very point; it has a flat, expanded and broadening front, with a sharp reverted edge, behind which is a rather strongly marked furrow, but no umbilicus.

Alt. 0·074 in. diam. 0·034. Mouth, breadth at same place, 0·005 inch. (*Wats.*).

Torres Strait, 3–11 fms.

Cylichna (*Volvula*) *sulcata* WATS., Chall., Rep. Gastr., p. 670, pl. 50, f. 6.

In form this somewhat resembles *Volvula angustata* A. Adams, but the sculpture is quite different. Compared to *Cylichna acuminata* A. Adams, the apex of the Challenger species is not spike-like and the spiral striæ are stronger. (*Wats.*).

Family SCAPHANDRIDÆ Fischer.

Shell spiral, external, the spire sunken or concealed. Animal with a short subquadrate foot, truncated or forked behind; frontal disc without tentacles, the posterior lobes obsolete; *epipodial lobes well developed.* Radula having the central tooth small, with a very large lateral on each side of it, and either a few smaller uncini or none. Gizzard containing three calcareous plates, which are not tuberculate.

This family differs from *Tornatinidæ* in the obsolescence of posterior lobes on the head-shield, in the well-developed radula, and the large lateral epipodial lobes. It differs from *Bullidæ* in the highly specialized form of the radula-teeth and their small number in a transverse row.

The form of the shell is so various in *Scaphandridæ* that no useful diagnosis of the family can be drawn from that organ. It would be very difficult to indicate any means of distinguishing the shells of some species of *Cylichna* from the genera *Retusa* and *Haminea*, although the soft parts of these three genera are very different. As in the case of *Tornatinidæ*, the present monograph does not pretend to be a sufficient account of all the species, much less to decide authoritatively questions of synonymy. In the present state of conchology, all systematic work on Tectibranchs is of a tentative and superficial character; and if the following account serves the temporary purpose of bringing together all of the described forms and their literature, the object of the writer will be attained. It remains for those who have opportunity to observe living examples to properly classify many of the species.

Synopsis of Genera.

Genus SCAPHANDER Montfort.

Shell involute, oblong or ovate, the spire concealed by a callus, covered with a thin epidermis, spirally striated. Aperture as long as the shell, narrow above, much dilated below, the columellar lip concave, long; columella revolving around a hollow axis; parietal wall smooth.

Subgenus SABATIA Bellardi.

Shell like *Scaphander*, but parietal wall bearing an entering fold of callus.

Genus SMARAGDINELLA Adams.

Shell ovate, entirely open from the front and base; whorls hardly more than one; apex concealed; aperture nearly as large as the shell, ovate; parietal wall bearing a large spirally entering plate, forming a little cup projecting into the aperture.

Subgenus NONA H. & A. Ad.

Shell white, the outer lip rising well above the vertex.

Genus ATYS Montfort.

Shell solid, involute, oval, usually with spiral striæ at both ends; aperture projecting beyond vertex and base, the lip typically folded above the vertex; columella plicate or concave, generally partly reflexed over a small umbilicus. See text for subgenera.

Genus CYLICHNA Lovén.

Shell rather small and subcylindrical, the spire sunken and umbilicate or closed by a callus from the inner lip; rather solid; aperture as long as the shell, narrow above, somewhat dilated below; columella short, thickened, sometimes sinuous. For subdivisons see text.

Genus DIAPHANA Brown.

Shell small, *thin*, corneous-brown, umbilicated, swollen, the last whorl shouldered or globose; spire low or sunken in an apical umbilicus. Aperture as long as the shell, rising above the vertex; peristome thin. For subdivisions see text.

Genus SCAPHANDER Montfort, 1810.

Scaphander Montf., Conch. Syst. ii, p. 334, type S. lignarius.—*Assula* Schum., Essai, etc., p. 78, 258, type *A. convoluta*=*B. lignaria* L. (1817).—*Gioeni* Gioeni, Descriz. di una nuova Fam. e di un nuovo Gen. di Testacei, trovati nel littorale di Catania, p. xxv, (iii to xxxiv), plate, figs. i–xiii, Naples, 1783 (Gizzard with plates, etc., of *S. lignarius*).—*Gicenia* Brug., Encycl. Meth. i. p. 502 (article "char").—*Tricla* Philipsson, Dissertatio Hist.-Nat., Nova Testaceorum Genera, p. 8, Lund, 1788 (gizzard with plates).

Shell entirely external, imperforate, ovate, rather solid, with the vertex narrow, concave and closed by a callus over the spire; aperture as long as the shell, sinused behind, narrowed above, dilated and effuse below; columella long, simply concave, with reflexed, appressed edge. Type *S. lignarius.*

Animal (pl. 32, fig. 24, *S. lignarius*) with a large pentagonal or hexagonal frontal disc, the posterior margin produced in two broad, short subobsolete lobes; no eyes; foot about the length of the shell, truncated behind; lateral lobes large and well developed. Gizzard (pl. 61 fig. 36 lateral view, fig. 37 dorsal view) armed with two large flattened subtriangular plates (pl. 61, fig. 33, pl. 32, fig. 25) and one lanceolate, laterally-compressed plate (pl. 61, figs. 34, 35). Radula narrow and minute, tooth-formula 1·1·1. The central teeth are small, subquadrate, subobsolete, not denticulated. Lateral teeth large, sickle-shaped (pl. 61, figs. 39, 40, *S. lignarius*).

The form of the shell is quite characteristic, but the main peculiarities of the animal are anatomical. The dentition is altogether peculiar, although showing much affinity to that of *Diaphana* and *Atys;* the external anatomy is most like *Atys;* the gizzard plates are characteristic, two being very large and subtriangular, while the third is folded upon itself and of a narrow, lanceolate form, fitting between the large ones.

Not unnaturally, the gizzard with its plates has been described as an independent genus, and two generic names have been applied to it, both prior in date to *Scaphander;* but Draparnaud in 1800 discovered their true nature, and it was also known to Montfort.

Besides the typical group of *Scaphander*, in which the parietal wall of the aperture is smooth, a subgenus *Sabatia* has been instituted by Bellardi, for forms in which there is a parietal entering callous fold. These lead the way toward the genus *Smaragdinella*

S. LIGNARIUS Linné. Pl. 31, figs. 21, 22, 23, 17.

Shell large, solid, ovate, attenuated above, abruptly truncated at the narrow vertex, dilated below. Surface unevenly grooved throughout, the grooves much closer above and below. Aperture as long as the shell, widely sinused above, where the excavated outer lip is inserted on the calloused, concave vertex; much dilated below, and effuse. Columella very concave, bordered by an even reflexion of callus which continues up the parietal wall to the vertex. Viewed from the base, all the whorls are seen within the spiral turns of the columella. Color rich reddish brown. Alt. 60 mill.

Atlantic Ocean from Norway to Gibraltar; Mediterranean Sea.

Bulla lignaria LINN., Syst. xii, p. 1184.—*Scaphander lignarius* MONTF., Conch. Syst. ii, p. 334.—JEFFREYS, Brit. Conch. iv, p. 443, v, p. 224, pl. 95, f. 5.—BUQ., DAUTZ. & DOLLF., Moll. Mar. Rouss. i, p. 536, pl. 63, f. 1–3.—SARS, Moll. Reg. Arct. Norv. p. 292, pl. 18, f. 7 (Shell), pl. 26, f. 4 (Animal); pl. xi, f. 13 (dentition, anatomy).—*Assula convoluta* SCHUM., Essai, etc., p. 258.—*S. giganteus* RISSO, Hist. Nat. Eur. Mér. iv, p. 51, pl. 2, f. 12.—*S. targionius* RISSO, *t. c.* pl. 2, f. 13.—*S. brownii* LEACH, Syn. Moll. G. B. p. 40.—*Giœnia sicula* BRUG., Encycl. Méth. i, p. 502.

Of this common and well known species we have given above but few references to books, but most of the others may be found in the works cited. It is the largest of the genus. Its food, according to Mme. Jeannette Power (Ann. Mag. N. H. (2), xx, p. 335) consists of *Dentalium*, the shells of which are triturated by means of the solid gizzard-plates.

Var. *minuscula* Monts. Small and pale colored, sometimes reddish above.

Var. *targionia* Risso. Rather less swollen than the typical form.

Var. *brittanica* Monts. Moderate sized, shorter and more swollen than the type. Atlantic (pl. 31, fig. 17).

Var. *curta* Jeffr. Very small and short.

Var. *hidalgoi* B. D. D. Small, deep brown, with more numerous and closer spiral striæ (fig. 22).

Var. *alba* Jeffr. Entirely white, with a creamy cuticle.

Fossil forms of this species have been described under the names *S. sublignarius* Orb., *S. grateloupii* Mich., and *S. fortisii* Grat. (not Brong.). It is wide spread in the Pliocene of Europe.

S. PUNCTOSTRIATUS Mighels. Pl. 31, fig. 16.

Shell rather solid, ovate, somewhat narrower but not constricted above, the vertex very narrow, scarcely truncated. Surface sculptured with fine spiral, *distinctly punctured* grooves. Vertex narrow, not distinctly margined, and but slightly concave, the lip inserted in the middle. Aperture narrow above, broad below; outer lip receding toward the upper insertion, somewhat effuse below. Columella broadly concave, bordered by a narrow white callus, the parietal callus slight and translucent. Only the last whorl is visible from the base. Color buff or pale brown, the interior of the aperture shining, porcellanous, white. Alt. from 8 to 30 mill.

Iceland, Shettland and Norway to Bay of Biscay, and off Azores (1000 fms.); *Palermo*, 60 fms.; *northwest Atlantic from Maine and Massachusetts to Culebra I.*, (390 fms.) *and Barbados* (288 fms.), *and Gulf of Mexico*, 533 fms.

Bulla punctostriata MIGH., Proc. Bost. Soc. N. H. i, 1841, p. 49; Bost. Journ. N. H. iv, 1842, p. 43, pl. 4, f. 10.—*Scaphander punctostriatus* GLD., Inv. Mass. (edit. W. G. B.), p. 215, f. 505.—VERRILL, Tr. Conn. Acad. vi, p. 273.—DALL, Blake Gastr., p. 52.—SARS, Moll. Reg. Arct. Norv., p. 292, pl. 18, f. 6.—JEFFREYS, Brit. Asso. Rep. 1884, p. 554.—WATSON, Chall. Rep. Gastr., p. 642.—A. AD., Thes. ii, p. 575, pl. 121, f. 50.—SOWB., Conch. Icon., f. 2.—*S. librarius* LOVEN, Ind. Moll. Scand. in Ofv. Vet. Akad. Forh., 1846, p. 142.—JEFFREYS, Brit. Conch. iv, p. 446; v, p. 224, pl. 102, f. 9; P. R. S. Lond. xxv, p. 185, 194, etc.; Ann. Mag. N. H. (4), xix, p. 335.—MONTS., Enumerazione, etc., p. 51.

This species inhabits comparatively shallow water in the north, but the southern localities are all for examples dredged in great depths. The regularly ovate form and conspicuously punctate striæ are its more prominent features.

Var. *clavus* Dall.

These specimens exhibit a bluntness at the apex and a more Bulla-like form than the typical ones, and may form a variety clavus, distinguished from the type by the above features and by the simple apex, where the axis is prolonged into the outer lip directly without being twisted so as to form a sort of cup, as in the type of the species.

West Indies, 288–553 fms.

S. GRACILIS Watson. Pl. 31, figs. 19, 20.

Shell thinnish, oblong, slightly flattened, a little narrowed upward, obliquely truncate at the top, where the outer lip rises like a tooth on the right; in front it is a little oblique toward the right, very little expanded, rounded towards the point. The mouth is pear-shaped and small for the genus. Sculpture: Longitudinals—the lines of growth are very slight. Spirals—the whole surface is dotted over with fine remote stipplings somewhat variable in size and shape, running in rather oblique spiral lines, which are a little crowded above and distant in front, where, however, an additional finer line of minute stipplings is often intercalated. Epidermis membranaceous, pale lemon-yellow. Colour dead white, with occasional translucent longitudinal bands. Crown consists of the bluntly rounded edge of a small shallow round pit, which is partly or wholly choked up with the labial callus; the line across the crown is very oblique. Mouth rather small, pear-shaped, and nearly straight. Outer lip slightly thickened and reflected on the crown of the shell, from which it rises upwards and projects forward like a tooth; from this point it advances almost straight with a patulous and scarcely convex edge to the beginning of the base, whence it sweeps round, retreating and very patulous to the point of the pillar. Inner lip very slightly convex above, almost straight in its oblique course across the base; on all this part a thickish well-defined glaze is spread on the front of the body; as the mouth begins to widen, this glaze is pressed out into a blunt angulation, almost a tooth, which is prolonged to the left in the narrow-edged, flat-fronted, truncated, twisted, concave pillar; here the reverted callus, which dies out at the point of the pillar, has behind it a small shallow flat furrow leading up into a pore-shaped umbilicus. Looking up the axis of the shell, though the opening is rather narrow, two whorls can be distinguished. Alt. 0·62 in. diam. 0·34. Greatest breadth of mouth, 0·24 inch. (*Wats.*).

West of Azores, and off San Miguel, Azores, 1000 fms.

S. gracilis WATS., J. L. S. Lond. xvii, 345; Chall. Gastr. p. 645, pl. 48, f. 4.

This is a long and narrow shell with little of the generic peculiarity of shape, though the anterior splay form is recognizable. The singular thickening of the pillar seems to increase with age. In the three specimens from station 78 it is much more strongly marked than in the somewhat younger shells from Station 73. The young

shells of *Scaphander puncto-striatus* (Migh.) are squatter, rounder, with a flatter crown, and have the outer lip less produced behind; their stippled sculpture, which varies a good deal, is often coarser, and forms more continuous spirals; the pillar-lip, too, and shape of the body are very different. In one of the specimens, from station 78 in particular, the slow wasting away of the surface has scarcely attacked the stippled pits of the spirals which accordingly remain projecting as flat round tubercles.

Specimens probably referable to this species are also said to have been collected by the 'Challenger' off Sydney, E. Australia, in 410 fms., an extraordinary distribution if really established (See Smith, Proc. Mal. Soc. Lond. i, p. 60).

S. WATSONI Dall. Pl. 31, fig. 18.

Shell slender, delicate, white or yellowish, polished, posteriorly attenuated, with the outer lip and aperture produced behind the apex; transverse sculpture, none beside the delicate lines of growth, which are perceptible chiefly at or near the tips; spiral sculpture consisting of some twenty-five sharp, strong, channelled, clear-cut grooves, not punctate or in any way irregular, except that they are more crowded near the summit than elsewhere, about half being within the posterior third of the shell; between these near the extremities, and near the margin of the outer lip, are a few more delicate intercalary grooves; posterior apex a minute pit, punctured in the centre, from which the free margin rises, extends backward somewhat more than half a millimeter, then downward, forward almost in a straight line, then with a wide sweep up and around to join the slightly thickened margin of the body, into which it passes imperceptibly; body with a light-wash of callus; axis coiled so as to be pervious to the summit when viewed from in front. Lon. of shell and aperture, 8·75. Max. lat. of body, 2·5; of entire shell, 4·25; of aperture, 3·25; min. lat. of aperture, 0·75 mill. (*Dall*).

Off Sombrero Island, 54–72 fms.; *Barbados*, 100 fms.; *off Bahia Honda*, 84 fms; *off Hatteras*, 63–324 fms.

Scaphander ? watsoni DALL, Bull. M. C. Z. ix, p. 99, 1881.—*Scaphander watsoni* DALL, Blake Rep., p. 52, pl. 17, f. 10.

It is possible that this will prove to be a *Philine* when the animal is known, but the form and aspect are those of a Scaphander. In general outline it recalls *S. lignarius* L., though more slender, more attenuated and pointed behind and with the free margin more

produced posteriorly. In the former characters it resembles *Philine Loveni* Malm, as figured by G. O. Sars, but is still more pointed behind, and the free margin is of quite a different shape. (*Dall*).

Adults of this species were taken at station 2376 by the U. S. Fish Commission in 324 fms. The shells alone were received. They are the American analogue of the European *Scaphander lignarius*, which they resemble more closely than any other species, but from which they can be distinguished by their uniformly more slender and cylindrical form and greater posterior attenuation. These differences hold good for the young as well as the adults. The outer lip generally rises higher, and the space on the posterior end of the spire is less wide and excavated in *S. watsoni* than in the other species, but these characters vary somewhat in both species. I doubt if *S. watsoni* ever reaches the size of the Mediterranean form; the largest I have seen measured 38·0 mm. long by 19·0 mm. in greatest diameter. *S. lignarius* of the same length generally measures about 24·5 mm. in diameter.

The magnificent *S. nobilis* Verrill, first dredged in 1209 fms., off Delaware Bay, was also found in the Gulf of Mexico by the U. S. Fish Commission in 1639 fms., at Station 2127.

S. NOBILIS Verrill. Pl. 32, figs. 31, 32.

Shell large, swollen, stout, broad-ovate in outline, thin, translucent, and of an exceedingly delicate texture. The body-whorl is very large in proportion to the rest of the shell. The aperture is large, broad-ovate in the anterior part, narrowed and curved posteriorly, extending to the apex of the shell, where it terminates in a notch, the outer lip extending back considerably beyond the notch. The aperture is much encroached upon by the convexity of the body-whorl, but about the middle the inner lip is strongly excavated and forms a broad and somewhat sinuous curve; the outer lip is very broadly and evenly rounded throughout most of its extent; anteriorly the curvature forms the arc of a circle; posteriorly it extends back beyond the apex of the shell in the form of an obtuse and slightly everted process, with its posterior margin concave, somewhat sinuous and spiral, and a little thickened. The surface is smooth and polished, somewhat shining, and everywhere covered by spiral lines formed by series of oblong dots, which are decidedly sunken below the surface and separated by intervals about equal to or less than their own length. The spiral lines are unequal in fineness, the

broader ones alternating with finer ones in which the dots are very narrow ; the intervals between the spiral lines are also variable in breadth. None of the specimens appear to have a distinct epidermis. Length of shell to apex of one of the largest specimens 35 mill.; breadth, 25 mill.; length of aperture, 37 mill.; greatest breadth of aperture, 18 mill. (*V.*).

Off Martha's Vineyard, in 906–1309 fms.; *off Delaware Bay,* 1091–1209 fms.; *East from Tobago,* in 880 fms. (Albatross).

S. nobilis VERRILL, Trans. Conn. Acad. Sci. vi, p. 209, pl. 32, f. 18, 18*a*, (shell); f. 18*b*, *c* (dentition); f. 18*d* (gizzard).—DALL, Blake Gastr. p. 53; Proc. U. S. Nat. Mus. xii, p. 297.

This species bears some resemblance to *S. punctostriatus* (Migh.) H. and A. Ad., but is much thinner, with a far more delicate texture. Its form is much shorter and more swollen in the middle, and the spiral lines are less numerous, with wider intervals, and have the punctations larger and not so close together, giving a much smoother appearance to the surface, although the punctate character is quite as evident. The aperture is also much broader, especially in its anterior half, while the body-whorl projects into it much more strongly. The inner lip is much thinner and shows only a slightly thickened fold along the columella-margin. Posteriorly the shell is not at all narrowed, but is evenly rounded, instead of being pinched up as in *S. punctostriatus.* The posterior process of the outer lip is more flaring, and extends farther backward beyond the apex. The apex of the shell is nearly plain and smooth, though sometimes slightly indented, and does not have a thickened deposit of enamel extending beyond the edge of the notch, as in the latter. (*V.*).

S. INTERRUPTUS Dall. Pl. 32, fig. 26.

Shell in many respects resembling *S. lignarius,* and best described by comparison with it. Shell of a livid or grayish straw-color, not the yellow or reddish-brown of *lignarius;* the tip of the spire is smaller in proportion and more pointed; the axis is pervious as in *lignarius,* but the perforation is more cylindrical and does not become funnel-shaped as the shell enlarges to maturity; the shell averages more slender; the callus on the body is not reflected so far, and especially on the anterior part of the pillar; the grooves of the surface in *lignarius* without exception are continuous, the punctures being arranged along their channels; in *S. interruptus* the spiral

sculpture is composed of rows of short or longer punctations or grooves, which do not unite to form a continuous line except close to the columella in front, and here rather as the result of crowding and overlapping; these short grooves are not punctate at the bottom as in *S. lignarius*, but are apt to alternate stronger and weaker, and are more close set than in *lignarius* of the same size.

Alt. 33, diam. 17·5 mill.; diam. of aperture 13·5 mill. (*Dall*).

West coast of Patagonia, 1050 fms.; *near Galapagos Is.*, 812 fms.

S. interruptus DALL, Proc. U. S. Nat. Mus. xii, p. 297, pl. 12, f. 12, 1889.

S. MUNDUS Watson. Pl. 31, figs. 13, 14.

Shell obliquely oval, thin, opaque, ivory-white, glossy, stippled in spiral lines, above narrowed obliquely, concavely truncated, and on the right bluntly pointed, below rounded. Sculpture: Longitudinals —there are very fine hair-like lines of growth, with slight irregular interrupted and unequal undulations. Spirals—the whole shell is covered with small shallow distant impressed dots: these above are roughly rounded or obliquely longitudinal; but from about one-third of the way down they become transversely elongated; they are arranged in rows not quite equal, and which are parted by intervals of fully double the breadth of the dotted rows; toward the point of the base the dots tend to return to the round shape, and the rows of largish dots are parted by rows of minute transversely elongated dots which occur in the intervals. Besides these, there are over the whole surface the close-set superficial microscopic spiral lines, which seem to be a characteristic of the genus. Epidermis excessively thin, membranaceous, and glossy, of a faint straw colour. Colour ivory-white. Crown oblique. There is a slight indentation or small conical pit almost completely coated with the glaze of the lip; this little pit is encircled by a very slight and blunt keel. Mouth irregularly pear-shaped, being somewhat narrowed above and expanded below. Outer lip projects a little angularly behind, and here it is reverted, thickened, and appressed; from the highest point of its rise it sweeps round to the point of the pillar with a very equable curve; it is very patulous on the base. Inner lip flexuous, being very convex on the body and openly concave on the pillar. A very thin glaze extends from the outer lip above across the body to the pillar, which has a pretty strongly reverted rounded and twisted edge, up which one can just see into the interior of the shell for nearly two

turns. Alt. 1·15 in. diam. 0·78. Greatest breadth of mouth, 0·61 inch. (*Wats.*).

Off Arrou I., west of Papua, 800 fms.

S. mundus Wats., Chall. Rep. Gastr., p. 643, pl. 48, f. 2.

This is a delicately beautiful shell, curiously intermediate between *Scaphander lignarius* (Linne), and *Scaphander puncto-striatus* (Migh), while perfectly distinct from both. In form it is less like a Bulla than the latter, while the attenuation above is less, and the expansion of the outer lip below is even greater than in the former. Lying on its face, it is broader and is more flattened, and that, too, more obliquely than either. Its puncto-striate spiral sculpture approaches that of *Scaphander punctostriatus* (Migh). *Scaphander nobilis* Verrill, is a good deal like, but then the proportion of the body-whorl to the size of the mouth is greater, and the outer lip rises higher and bends more to the left at the top of the shell; the whole shell, too, is narrower. (*Wats.*).

S. multistriatus Brazier. *Unfigured.*

Shell white, thin, transparent, oblong ovate, transversely, obliquely, and closely striated, attenuated towards the spire; spire truncated, slightly umbilicated; aperture pyriform; outer lip slightly inflated above, from the centre to the base widely expanded a little thickened; columella obliquely somewhat faintly plicated. Length, 3¼ lines; breadth at spire, 1 line; at centre, 1¾ lines; base, 1½ lines; aperture circle at spire, 1¼ lines; at centre, 1½ lines. (*Braz.*).

Darnley Island, Torres Straits, 30 fathoms, sandy mud.

S. multistriata Braz., P. L. S. N. S. W. ii, p. 84.

S. niveus Watson. Pl. 31, fig. 15.

Shell thinnish, obliquely oval, slightly narrowed and rounded above, where the outer lip rises on the right like a tooth; in front it is rounded with a very blunt angulation at the point of the pillar; ivory-white, glossy, striate, but scarcely stippled. The body is rather tumid, and shaped like a Bulla. Sculpture: Longitudinals —there are exceedingly faint hair like lines of growth, of which, at at frequent intervals, one more distinct produces a slight undulation of the surface. Spirals—the whole shell presents the microscopic and very superficial crimpings of the genus, which become rather strong on the base; there are also some very superficial and extremely obsolete bandings or furrows and ridges, which are

scarcely appreciable. Besides these, the upper half of the shell and the point of the base are scratched with fine square-cut striæ, which, with a little difficulty, can be recognized as formed of minute contiguous stipplings; these are very remote in the middle of the shell, but toward either extremity they become crowded. Epidermis membranaceous. Colour white, with a faint ivory tinge. Crown consists only of the flatly rounded margin of a very small pit-like depression in front of the origin of the outer lip, which rises abruptly above the top of the shell. Mouth curved, rather club than pear-shaped, being gibbously enlarged in front and elongate and rather narrow behind. Outer lip thickened, reflected, and sinuated above, where curving forwards, it rises in a tooth-like form above the crown; from this point it sweeps very equably round to the point of the pillar, the curve being very slightly flattened above and somewhat full on the base; it is patulous throughout; the very thin edge is nowhere very prominent. Inner lip roundly convex on the body, bluntly angulated at the top of the short scarcely curved and barely truncate pillar. A thickish and rather prominent glaze joins the two extremities of the outer lip; near its edge on the upper part of the body this glaze has a few irregular rounded tubercles; on the base, where it is thickened to a pad, these tubercles increase in size and number, while the reverted pillar-lip is harshly covered with them. The pillar lip is not quite closely appressed, having an overhanging edge and a closed chink behind it. Alt. 1·15, diam. 0·8. Greatest breadth of mouth, 0·56 inch. (*Wats.*).

South-east of the Philippines, 500 fms.

S. niveus Wats., J. L. S. Lond. xvii, p. 343; Chall. Rep., p. 644, pl. 48, f. 3.

Only one specimen of this species having been found, it is impossible to say whether the roughening of the labial glaze is a specific feature as in some of the Volutes, or the result of disease. In this species the general form of the shell, and especially that of the body-whorl is even liker a *Bulla* than is the case with *Scaphander punctostriatus* (Migh); but the apex is not perforated. As in that species one, looking up the pillar, can only see a single complete whorl. The minute stippling of the spirals resembles, on a still smaller scale, that feature in *Scaphander lignarius* (Linne). Compared to *Scaphander mundus* Watson, this is a much more tumid form, and the sculpture is markedly different. (*Wats.*).

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S. JAPONICUS A. Adams. *Unfigured.*

Shell ovate, elongate, narrowed behind, dull white, transversely sulcate, the sulci rather closely puncticulate; spire concealed; aperture coarctate behind, dilated in front; inner lip thin; outer lip, produced and obtusely angled posteriorly, rounded in front, the margin regularly arcuate. (*Ad.*, Ann. Mag. Nat. Hist. (3), ix, p. 156).

Mino-Sima, Japan, 63 fms.

The punctate striæ are common to most of the species of this genus. The present species nearly resembles *S. lignarius* in form, but is much smaller (only half an inch long); it is also less ventricose, and transverse grooves are puncticulate. (*Ad.*).

S. CUMINGII A. Adams. *Unfigured.*

Shell oblong-ovate, constricted behind, whitish, transversely obliquely sulcate, the sulci closely puncticulate; aperture ample, strongly coarctate behind, dilated and slightly effuse in front; inner lip lengthened, subreflexed outwardly; lip produced and acutely angled posteriorly; hind margin inflexed, anteriorly crenulated. (*Ad.*, *l. c.*, p. 156).

Mino-Sima, 63 fms.

Differs from *S. japonicus*, which it equals in size, in the last whorl being posteriorly constricted, in the close-set oblique grooves, in the narrowness of the last whorl, and in the acute hind angle of the outer lip. (*Ad.*).

S. ELONGATUS A. Adams. *Unfigured.*

Shell thin, white, elongate-ovate, narrowed at both ends, transversely sulcate, the sulci distant, punctate; aperture produced in front and dilated, coarctate behind; inner lip thin; outer lip with regularly arcuate margin. (*Ad.*, *l. c.*, p. 157).

Mino-Sima, Japan, 63 fms.

This species is elongate and narrowed at both ends, and the punctate grooves are wide apart. The spire of this and of all the other species is "truncata umbilicata," or "occulta." (*Ad.*).

S. SULCATINUS A. Adams. *Unfigured.*

Shell elongate, somewhat solid, posteriorly narrowed, tawny, shining, transversely sulcate, the sulci simple and distant; aperture coarctate posteriorly, dilated anteriorly; inner lip simple; outer lip with regularly arcuate margin. (*Ad.*, *l. c.*, p. 157).

Korea Strait, 46 fms.

This is a small, smooth, rather solid species, transversely sulcate; the grooves fine, simple, and more strongly marked at the posterior extremity. (*Ad.*).

S. SIEBOLDII A. Adams. *Unfigured.*

Shell small, oblong, white, rather thin, coarctate behind, rather swollen in the middle, transversely sulcate, the sulci distant and punctate; aperture ample, very much dilated below, narrow above; inner lip reflexed behind, thin and arcuate in front; margin of outer lip slightly straight, posteriorly produced and strongly angled. (*Ad. l. c.*, p. 157).

Tsu-Sima, Japan, 26 fms.

This may be a *Philine*. "The only species at all resembling this is *S. pectinatus;* from which, however, it differs greatly; it is very loosely convolute, and the last whorl is gibbose in the middle. (*Ad.*).

S. DILATATUS A. Adams. *Unfigured.*

Shell ovate, posteriorly narrowed, loosely convoluted, white, thin, transversely striated, the striæ close and simple; spire small; aperture ample, narrowed behind, much dilated in front; inner lip thin; outer lip with regularly arcuate margin, posteriorly produced and acutely angled. (*Ad., l. c.*, p. 157).

Tsu-Sima, Japan, 26 fms.

This species is probably a *Philine;* but as I have not seen it, and it was described as a *Scaphander*, the safest course is to leave the form in the latter genus. "This is a slightly convolute, thin, oblong species, with the transverse lines waved but not punctate, and the aperture greatly dilated."

Subgenus SABATIA Bellardi, 1876.

Sabatia BELL., Bull. della Soc. Mal. Italiana, ii, p. 209, type *S. isselii* BELLARDI, *l. c.*, p. 210, pl. C, f. 5–8.—DALL, Blake Gastr., p. 53.

Shell ovate or short-oval, with the aperture as long as the shell, dilated below as in *Scaphander;* columella simply concave in adult shells, the parietal wall bearing a spirally entering plicate or smooth callus. Anatomy unknown. Type *S. isselii* Bellardi, pl. 32, figs. 33, 34.

The type of this group is a pliocene fossil of Piedmont in which the callus is plicated. Fig. 34 shows the front view, fig. 33 a dorsal view with the body-wall removed to show the internal continuation of the spiral callus. *Bulla grandis* Seguenza (Form. Terz. di Reggio, p. 250, pl. 16, f. 4, 1880) is another fossil species of the same group. In the recent fauna it is known only from deep water in the Antillean district.

S. BATHYMOPHILA Dall. Pl. 32, figs. 27 (adult) and 28 (young).

Shell large, stout, white, polished, sculptured with numerous puncticulate striæ, crowded toward the ends and few and distant in the middle; outer lip extending backward a short distance from the spire, then sweeping downward, forward, outward, and then upward, curving downward and backward again to join the subtruncate columella, above and behind which there is almost a canal; columella reflected, with a tolerably thick callus, but no umbilicus or umbilical chink; body with a thin deposit of callus (in one instance much thickened and roughened, apparently by disease); aperture very narrow behind, very wide and somewhat oblique in front; lines of growth on the surface hardly visible. Lon. of shell and aperture, 16·5; from summit to oblique truncation of columella, 13·75. Max. lat. of shell, 11·25; of aperture, 7·0; min. lat. of aperture, 1·0 mill. (*Dall*).

Alt. 31, diam. 24 mill.

In young specimens 3·5 mm. long there are three and a half whorls; the nucleus is visible turned on its side and half immersed; it is heliciform, translucent white and minute; the striation is more uniformly distributed over the shell and is exceedingly fine; the nucleus (but not the whorls outside of it) remains partly visible until the shell has attained a length of 8·25 mm. Like most young shells of this group the young are more pointed before and behind, and less expanded than the adult.

100 *miles east from Delaware Bay*, 554 fms.; *Fernandina, Florida; Yucatan Strait*, 640 fms.; *east from Tobago*, 880 fms.

Atys ? *bathymophila* DALL, Bull. M. C. Z. ix, p. 98, 1881.—*Sabatia bathymophila* DALL, Amer. Nat. xvi, 1882, p. 884; Blake Gastr., p. 53, pl. 17, f. 9, 9*b*; Proc. U. S. Nat. Mus. xii, p. 298, 1889.

The exterior of this species has the general form of *Scaphander nobilis*, but the minute sculpture and the characteristics in detail are alike distinct.

Additional and mature specimens of this species appear in the collections of 1878–79, from Station 162, off Guadeloupe, in 734 fms., fine gray mud ; bottom temperature 40·0°. These specimens show that the truncation of the axis is a character of the immature shell, and that the adult shows nothing of it, but has the body from one end to the other supplied with a broad solid flattened callus, which is especially protuberant (into the aperture) at the beginning of the posterior third. The outer margin of the callus has a sigmoid curve parallel with the inner outline of the columella and body ; the inner margin is, however, somewhat irregularly transversely wrinkled, the mass of callus is much thicker in the middle third, and its surface is ornamented with flattened pustulæ irregularly disposed. This gives to the shell an abnormal appearance, which I took, in the single large (but as we know, immature) specimen referred to in the description, as an indication of disease in the individual. More material shows these characters to be normal and constant in their general features in the adult shells. The form of the aperture is well shown in the figures ; its anterior portion is very oblique,—a feature only visible in a side view.

The type species, *Sabatia isseli* Bellardi, bears no special resemblance to this shell ; it is of quite different shape, sculpture, and proportions, with a callus more simple and proportionately less developed. In the latter a minute dimple indicates the position of the wholly immersed apex in the adult, while in the young the rough callus, though thin, is distinctly apparent in a specimen only 4·0 mm. long, and which has the nucleus and about three turns visible on the apex. The nucleus is reversed and half immersed, smooth and translucent. It is not wholly covered by callus until the shell is more than 7·0 mm. in length. When half covered it resembles the genus Cryptaxis of Jeffreys. The sculpture in the very young is the same as in the adult. *Scaphander niveus* and *gracilis* of Watson probably belong to this group. (*Dall.*)

Genus SMARAGDINELLA A. Adams, 1848.

Smaragdinella A. Ad., Appendix to Capt. Belcher's Narrative of the Voyage of H. M. S. Samarang ii, p. 475, 1848. Type *Bulla viridis* Q.—H. & A. Ad., Gen. Rec. Moll. ii, p. 22.—*Glauconella*

GRAY, Figs. Moll. Anim, iv, p. 95 (for *G. viridis, glauca, smaragdina*), 1850.—*Linteria* A. AD., in Sowb., Thes. ii, p. 558 (1850).—*Thecaphorus* NUTT. *ms.. fide* Ads.

Shell mainly external, *oval, formed of little more than one whorl, the entire interior visible from the open front and base.* Apex concealed. *Aperture occupying nearly the whole ventral surface,* ovate, with a deep posterior sinus; columella long, curved, with a reflexed adnate callus, the *parietal wall bearing an oblique, curved, spirally entering plate,* which projects downward into the aperture. Type *S. viridis.*

Animal having a squarish frontal disc bearing well developed eyes, and obsoletely bilobed behind; foot about as long as the shell, squarish-oblong; epipodial (lateral) lobes well developed, partially covering the shell. Stomach with cartilaginous plates. Dentition unknown.

Smaragdinella lives between tides, exposed to the waves. Its green coloring assimilates the creature to its surroundings. Two subgenera are recognized: SMARAGDINELLA Ad., shell oval, green. (2) NONA Ads., shell white, subtrigonal, the lip more produced above.

S. VIRIDIS (Rang) Q. & G. Pl. 33, figs. 42, 45, 46, 47, 48, 49–53.

Shell oval, solid, dark green, consisting of about 1½ whorls; entirely open from the front and base, the aperture occupying nearly all of the ventral aspect; dorsal surface regularly rounded; apex concealed, the vertex in some old shells marked by a tiny keel-encircled cup; sculptured with irregular growth lines. Aperture ovate, having a narrow sinus behind, elsewhere broadly rounded. Outer lip thin, rising somewhat above the vertex behind; columellar lip arcuate, nearly as long as the shell, slightly thickened, and with a reflexed adnate callus running backward to the vertex; from this callus springs a wide entering plate, spirally twisted into a saucer-like process projecting into the aperture.

Alt. 12, diam. 8½ mill.

Island of Bourbon; Réunion; Guam; Sandwich Is.

Bulla viridis RANG, in Q. & G., Voy. Astrol. Zool. ii, p. 350, pl. 26, f. 13–16.—*Linteria viridis* AD. in Thes. Conch. ii, p. 597, pl. 121, f. 52.—SOWB. in C. Icon., f. 3.—*Smaragdinella viridis* ADS., Gen. Rec. Moll. ii, p. 23.—MARTENS, Donum Bism., Samml. Südsee-conch. p. 53; Meeres-Fauna Maurit. etc., p. 304.—*Linteria glauca*

AD., Thes. p. 597, pl. 121, f. 53.—SOWB., C. Icon., f. 4.—*Glauconella viridis* GRAY, Fig. Moll. Anim. iv, p. 95; Guide Syst. dist. p. 194. —*Bulla calyculata* SOWB., Genera, f. 5.—*Linteria acuminata* SOWB., Conch. Icon., f. 2, 1870.

We are unable to find characters in the shells sufficient to separate the *viridis* (typical figures 49–52), *calyculata*, *acuminata* (figures 56, 57 "Guadaloupe and Sandwich Is."), and the *glauca* of Adams (fig. 42) and of Sowerby (pl. 33, figs. 45, 46). It is doubtful whether the *glauca* of Q. & G. will prove distinct.

The species has also been reported from Pitcairn Island and Japan.

Var. FASCIATA Sowb. Pl. 33, figs. 54, 55.

Shell oblong, subovate, compressed, semipellucid, golden-brown, spirally 3-banded, slightly contracted above the center; aperture large, outer lip elevated, cuneate; last whorl very narrow, appendage long, acuminated. (*Sowb.*).

Habitat unknown.

Linteria fasciata SOWB., Conch. Icon., f. 5, 1870.

S. GLAUCA Quoy & Gaimard. Pl. 33, figs. 43, 44.

Shell a little more convoluted, more oval and more swollen above than *S. viridis;* sea-green. Animal about an inch long, the frontal disc quadrate, wide, pointed at the sides in front, a little excavated behind; color of the entire animal apple-green, visibly peppered with black, the mouth reddish, eyes black.

Port Carteret, New Ireland.

Bulla glauca Q. & G., Zool. Astrol. ii, p. 352, pl. 26, f. 10–12.

Described from one individual the shell of which was not in good condition. Adams and Sowerby have identified certain shells with Quoy's species, but their decisions are not to be trusted. The real distinctive characters are in the form of the frontal shield of the animal, and this may be due to the temporary condition of the individual seen by Quoy. The alleged conchological distinctions are quite insufficient.

S. MINOR A. Adams. Pl. 33, fig. 58.

Shell small, pellucid, yellow, thin, smooth, oval, aperture very wide, scarcely involute, longitudinally very finely, striated; an unguiculate process at the spire. (*Ad.*).

Island of Zebu, Philippines (Cuming).

L. minor Ad., Thes., p. 598, pl. 121, f. 54.—Sowb., C. Ic., f. 1.

May be only a variety of *S. viridis*, but distinguished by its shorter form.

S. andersoni Nevill. Pl. 33, figs. 40, 41.

Shell oval, glaucous, open, indistinctly longitudinally striate; spire a little involute; inner lip bearing a small appendage; aperture large, dilated in front, the anterior margin oval-arched, posterior margins somewhat coarctate.

Length 8½, diam. 6½, alt. 3½ mill. (*Nev.*).

S. Province of Ceylon, on reefs at low water (Nev.); *Penang* (Stoliczka); *Suez* (Cooke).

Glauconella andersoni G. & H. Nevill, Journ. Asiat. Soc. Beng. xl, pt. 2, p. 2, pl. 1, f. 13.—*Smaragdinella andersoni* Cooke, Ann. Mag. N. H. (5), xvii, p. 133.

This interesting species in shape closely resembles *G. viridis* Rang., the body of the shell is, however, considerably more involute and the colour a pale apple-green; it also differs from the above, as well as from all the other described species of the genus, in the small, almost rudimentary appendage. It is tolerably abundant on reefs at low water in the S. Province, Ceylon. Dr. Stoliczka also found it at Penang. The animal is dull greenish, mottled with brown, the eyes are sessile, very small and black; the shell is completely hidden by the meeting of the lateral expansion of the mantle, in this respect differing from *G. viridis*, in which according to A. Adams, the shell is only partially hidden. Its mode of progression, at the time, strongly reminded one of us of that of *Omphalotropis*. (*Nev.*).

S. sieboldi A. Adams. *Unfigured.*

Shell ovate-oblong, slightly involute, open, thin glaucous, pellucid, the back longitudinally striated; inner lip bearing a spiral lamella, scarcely dilated. (*Ad.*).

Takano-Sima, Japan, between tide marks.

Smaragdinella sieboldi Ad., Ann. Mag. N. H. (3), xiii, p. 310, 1864.—Dkr., Index, p. 167.

This species differs remarkably from the other species of the genus in the breadth of the spiral lamella which winds round the inner lip. In *S. viridis*, *S. glauca*, and *S. minor* the lamella is so broad

that it forms, when it winds, a cup shaped appendage. In *S. sieboldi*, however, the lamella is so narrow that a spiral ridge only is visible. (*Ad.*).

Glauconella adamsii Gray, (*Bulla smaragdina* Adams Mss.) is known only by three sketches by Adams of a living *Smaragdinella*, published in Gray's "Figures of Molluscous Animals," pl. 178, figs. 1, 1*a*, 1*b*; p. 95. It is, of course, quite unidentifiable.

Section NONA H. & A. Adams.

Shell internal, subtrigonal, slightly involute, white, fragile; inner lip with a cup-shaped appendage, spirally entering; outer lip produced posteriorly.

S. ALGIRÆ Hanley. Pl. 33, fig. 59.

Shell subtrigonal, white, thin, concentrically lightly undulated; aperture very large, trigonal, outer lip elevated above the spire, angulated, acuminated, contracted in the middle, anteriorly produced; columella much arched, last whorl small, trigonal; appendage small, acuminated. (*Sowb.*).

Algiers (McAndrew).

Linteria algiræ Hanley, A. AD., Thes., p. 598, pl. 121, f. 55.—SOWB., Conch. Icon. f. 6.—*Smaragdinella* (*Nona*) *algiræ* H. & A. AD., Gen., p. 23.

Genus ATYS Montfort, 1810.

Atys MONTF., Conch. Syst. ii, p. 343, type *A. cymbulus*=*naucum*.—*Alicula* EHRENBERG, Symbolæ Phys., decas 1st, 1831, type *A. cylindrica*.—*Naucum* SCHUM., Essai, p. 79, 259, type *N. striatulum* Schum.=*A. naucum* L.—*Roxania* LEACH ms., GRAY, P. Z. S. 1847, p. 161, type *B. cranchii*=*B. utriculus*.—*Roxaniella* MONTS., Nom. Gen. e Spec. p. 145, type *R. jeffreysi* Weink.—*Weinkauffia*. ADAMS.

Dinia ADS., Gen. Rec. Moll. ii, p. 21, type *D. dentifera*.

Shell varying from globose-oval to subcylindrical-oval, involute, the spire concealed; aperture as long as the shell, produced above the vertex; lip rising from the center of the vertex, and having an angular fold there; outer lip simple and arcuate; columella short, subreflexed, with a fold-like truncation, or arcuate, the umbilicus generally not wholly closed. Type *A. naucum*.

The anatomy of the typical forms is unknown. In the section *Alicula*, the frontal disc is wide-ovate, with no anterior or posterior auricles; epipodial lobes developed much as in *Scaphander*, but more prolonged posteriorly (pl. 59, fig. 16, 17, *A. cylindrica*, after Ehrenberg). Eyes absent.

In the subgenus *Roxania*, the large frontal disc is produced behind in two triangular lobes, the epipodial lobes being as in *Alicula* (pl. 59, figs. 13, *A. utriculus*). Eyes absent; foot quadrate, slightly bilobed behind. Gizzard-plates wanting.

Dentition (of *A. utriculus*) with the formula 1·1·1; central teeth well developed, with multicuspid cusp, slightly emarginate in the middle. Laterals large, subtriangular, with no dentate cusps; uncini wanting. It, therefore, agrees with *Diaphana* or *Cylichna* in the form of the centrals, with *Diaphana* and *Scaphander* in the absence of uncini; but it differs widely from all of these genera in the form of the lateral teeth (see pl. 61, fig. 32, *A. utriculus*, after Sars).

The shell in this genus frequently resembles that of *Cylichna* or of *Scaphander*, and the exact limits of these groups have not yet been clearly indicated. It is likely that *Atys* should be restricted to those forms in which the upper lip has an angular fold above its insertion in the vertex, and the forms lacking this feature may then be removed to constitute one or two distinct genera. We prefer to leave the genus, for the present, in its old limits, believing that this is preferable to a re-assortment of its contents prior to the necessary examination of the soft parts in the various subgenera proposed. No really intelligent systematic work can be done in this group by the shells alone.

The subgenera referred provisionally to *Atys* are as follows:

ATYS *s. str.* Shell swollen, having the lip plicate above the vertex, the columella obliquely truncated or angularly folded. Type *A. naucum.*

ALICULA Ehrenberg, 1831. Shell cylindrical; lip plicate above the vertex; columella not distinctly truncated or folded. Type *A. cylindrica.*

ROXANIA Leach. Shell cylindric-elliptical, with spiral punctured striæ; lip not twisted at its superior insertion; columella subvertical, slightly sinuous. Type *A. utriculus.*

We have above expressed the opinion that this group and the next may eventually be removed from *Atys*.

DINIA H. & A. Adams, 1854. Shell ovoid, subtruncate above, longitudinally striated; columella abruptly truncated below, ending in a tooth-like prominence. Type *A. dentifera* Ad.

The next two groups do not appear to offer any differential features of importance. All are characterized by the prominent truncation of the columella and the absence of a fold above the vertex.

Roxaniella Monterosato, 1884. Shell diaphanous, date-shaped, with spiral plicate sculpture; columella with a thickened sinuosity, simulating a fold. No fold above the vertex. Type *A. jeffreysi*. This group seems to be synonymous with *Dinia*.

Weinkauffia A. Adams. Type *A. diaphana* Arad. This group offers no tangible differences from *Dinia*.

Subgenus ATYS Montf.

A. NAUCUM Linné. Pl. 28, figs. 11, 12, 13, 14, 15, 16.

Shell globose-oval, inflated, widest at the middle, solid; white under a thin buff or chestnut cuticle. Vertex narrowly concave; body whorl sculptured throughout with engraved spirals, much closer and uneven toward the ends, more spaced or altogether absent in the middle; base concave around the rimate umbilicus. Aperture as long as the shell, the lip rising high above the vertex and angularly plicate there; columella vertical, angularly plicate or truncated in the middle; outer lip everywhere well curved.

Alt. 41, diam. 29 mill., often smaller.

Singapore, Borneo and Philippines to Torres Straits, eastward to Viti Is., westward to Red Sea and Madagascar.

Bulla naucum L., Syst. Nat. x, p. 726.—AD., in Thes. Conch. p. 584, pl. 124, f. 107–109.—*Atys naucum* SOWB., Conch. Icon. f. 1.—E. A. SMITH, Zool. Coll. Alert, p. 86.—BRAZIER, P. L. S. N. S. W. ii, p. 84.—MARTENS, Mobius' Reise n. Mauritius p. 302.—COOKE, Ann. Mag. N. H. (5), xvii, p. 131.—*Atys cymbulus* MONTF., Conch. Syst. ii, p. 343.—*B.* (*A.*) *ferruginosa* A. AD., Thes. ii, p. 585, pl. 124, f. 110 (not *B. ferruginosa* Gmel. p. 3432,=young *Cypræa*); Ann. Mag. N. H. (4), ix, p. 344.—*Atys ovoidea* AD., Thes. Conch.

p. 585, pl. 124, f. 111, and Sowb., Conch. Icon. f. 3 (not of Quoy & Gaimard).—*Atys freyi* Brancsik, Jahresh. Trencs. Com. xiii, p. 80. *Atys obovata* Mke., Mal. Bl. 1854, p. 46; Moll. Nov. Holl. p. 75.

Large specimens of this species are thinner than smaller adults; and examples of any size frequently develop an obtuse keel above the middle. Adams' *A. ferruginosa* (pl. 28, figs. 14, 15) is longitudinally marked with brown. Brancsik has described specimens from Nossi-be as *A. freyi* (pl. 32, fig. 37); they are solid and free from spiral incised lines in the middle; but some from Singapore before me agree in this, which seems to be only an individual variation. The *A. obovata* of Menke (*ovoidea* Adams and Sowb), shown in fig. 16 of pl. 28, is a stunted form of this species.

A. muscaria Gould. Pl. 28, fig. 20.

Shell minute, ovate-elliptical, thin, greenish, ornamented with transversely arranged brown dots, cut with striæ above and below; vertex funnel-shaped, imperforate. Aperture narrow, effuse in front, lip produced backward, toothed; columella short, twisted. Alt. 4, diam. 2 mill. (*Gld.*).

China Seas (Stimp.).

Atys muscaria Gld., Proc. Bost. Soc. N. H. vii, p. 138.—Sowb., Conch. Icon. f. 5.

A. tortuosa A. Adams. Pl. 33, figs. 66, 67.

Shell ovoid, produced at both ends, yellowish, pellucid, umbilicated, anteriorly and posteriorly transversely striated; outer lip posteriorly strongly twisted; inner lip anteriorly straight, with a single fold (*Ad.*).

Camaguin, Philippines (Cuming); *Torres Strait* (Brazier).

B. (*A.*) *tortuosa* Ad., Thes. p. 587, pl. 125, f. 120.—Sowb., C. Ic. t. 2, f. 15.—Brazier. P. L. S. N. S. W. ii, p. 87.

A. amphorella A. Adams. *Unfigured.*

Shell ovoid, ventricose, somewhat gibbous in the middle, rimate, thin, smooth, shining, buff, narrowed anteriorly, subacuminate posteriorly; inner lip nearly straight, slightly truncated in front; outer lip arcuate, posteriorly produced, tortuous, rounded (*Ad.*, Ann. Mag. (3), ix, p. 158).

Lo-shan-kow and Shan-tung, China.

Atys tortuosa A. Adams, is the nearest approach to this species which, however, is not striated, and the outer lip has not the spiral

twist so conspicuous in that species. My Chinese species is shaped like a little fat *Amphora* (*Ad.*).

A. SCROBICULATA A. Adams. *Unfigured.*

Shell ovoid, ventricose, narrowed behind, acuminate in front, dull white, broadly and profoundly umbilicated, margin of the umbilicus angulated; aperture much produced at both ends; columellar margin straight, simple; anteriorly rounded (*Ad., l. c.* p. 158).

Tabu-Sima, Japan, 25 fms.

The only shell which resembles this singular little species is *A. tortuosa* A. Adams; but the great peculiarity of the aperture, which is pointed at both ends and produced beyond the body whorl, distinguishes it from all others (*Ad.*).

Section ALICULA Ehrenb., 1831.

A. CYLINDRICA Helbling. Pl. 33, figs. 60, 61, 62, 63, 64.

Shell *elongated*, oblong-oval or subcylindrical, *solid*, white under a very thin buff cuticle; apex closed; body whorl more or less convex, sometimes indistinctly angular above the middle, *sculptured with incised spiral lines which become closer toward the ends, and are absent from the smooth middle third.* Lip heavy, rising obliquely far above the vertex, contorted and angularly plicate; outer lip gently convex; columella short, with a heavy, reflexed lunate callus, its outer edge not appressed, inner edge subconcave, *without fold or obvious truncation.* Alt. 27, diam. 13–14 mill.

Philippines to Torres Strait, eastward to Fiji Is.; westward to Ceylon, Andaman Is., Red Sea, Mauritius and Seychelles Is.

Bulla cylindrica HELBLING, Abhandl. einer Privat Gesellsch in Böhmen, iv, p. 122, pl. ii, f. 30, 31, 1779.—A. AD., Thes. Conch. ii, p. 585, pl. 125, f. 114.—*Atys cylindrica* SOWB., Conch. Icon. t. 1, f. 4.—SMITH, P. Z. S. 1878, p. 819.—MARTENS, Meeres-fauna Maurit. p. 303.—BRAZIER, P. L. S. N. S. W. ii, p. 85.—WATSON, Chall. Rep. Gastr. p. 639.—E. A. SMITH, Ann. Mag. N. H. (4), ix, p. 344.—*Bulla* (*Atys*) *elongata* A. AD., Thes. p. 587, pl. 125, f. 121.—*A. elongata* SOWB., Conch. Icon. f. 8.—BRAZ., P. L. S. N. S. W. ii, p. 85.—*Bulla solida* BRUG., Encycl. Méth. i, p. 374, pl. 146, f. 1356, 1357.—AD., Thes. p. 585, pl. 124, f. 112, 113.—*A. solida* SOWB., C. Icon. f. 4.—BRAZ., P. L. S. N. S. W. ii, p. 85.—ISSEL, Malac. Mar. Rosso, p. 168.—*Atys angustata* SMITH, Ann. Mag. N. H. (4), ix, p. 346. See Ann. Mag. (5), xvii, p. 132.—*A. succisa* A. AD., Thes. ii,

p. 586, pl. 125, f. 116.—Sowb., C. Ic. f. 10 (not of Ehrenb.).—*Bulla albicita* Dofo, Ann. Sc. Nat. xiv, p. 203.

This solid, elongated species has several typically quite divergent forms. It is normally moderately convex (figs. 60, 61); but sometimes much more cylindrical and elongated, and in this form has been called *A. elongata* (fig. 62). When subangular it has been named *A. solida* (figs. 63, 64); and another form, smaller than the type, has been called *A. succisa* (pl. 33, fig. 73) by Adams, but according to von Martens it is not the species so named by Ehrenberg.

A. PARALLELA Gould. Pl. 28, figs. 21, 22.

Shell small, thin, pellucid, milk-white, cylindrical, rounded at base, obtusely conical at summit, imperforate at apex; surface delicately marked with lines of growth, and these are crossed at the lower and upper third of the shell by somewhat conspicuous, minutely flexuous, revolving lines. The aperture is narrow, widening downwards; lip sharp, rising considerably above the apex of the spire, and at the same time inclining towards it, then turning downwards and entering the aperture by a twisted fold, at base it is rounded, and rises upon the columella in the shape of a thick callus, which is not appressed to the body of the shell (*Gld.*).

Alt. about 12½, diam. 5 mill.

Tahiti (Martens); *Levuka, Fiji* (Challenger).

Bulla parallela Gld., Proc. Bost. Soc. N. H. iii, p. 251 (Dec. 1847); U. S. Expl. Exped. p. 220, f. 267; *Cylichna parallela* Gld., Otia, p. 246.—*Atys parallela* Martens & Langk., Donum Bism. p. 53.—Sowb., in Conch. Icon. f. 21 *c* (and 21 *a*, *b* ?).—Watson, Chall. Gastr. p. 640.

A. DEBILIS Pease. Pl. 33, figs. 69, 70.

Shell cylindrically ovate, elongate, narrowed posteriorly, pellucid, fragile, white; outer lip produced and twisted posteriorly; apex umbilicated, and umbilicus striated or grooved, finely striated transversely, transverse raised lines at both ends; columella with a fold at the base (*Pse.*).

Alt. 10½, diam. 5 mill.

Sandwich Is.; *Levuka, Fiji.*

Atys debilis Pse., P. Z. S. 1860, p. 20; Amer. Jour. Conch. iii, p. 231.—Carpenter, P. Z. S. 1865, p. 516.—Martens, Donum Bism. p. 53, pl. 3, f. 3.—Sowb., Conch Icon. f. 28.—Watson, Challenger Gastrop. p. 640.

A. COSTULOSA Pease. *Unfigured.*

Shell elongate, subcylindrical, narrowest posteriorly, white, umbilicate, longitudinally ribbed, crossed at either end by elevated striæ, which become more remote towards the middle of the shell and gradually vanish; outer lip posteriorly strongly twisted and produced; columella everted at base, flattened and appressed; aperture narrow.

Oahu (Pse.).

A. costulosa PSE., Amer. Journ. Conch. v, p. 73.

I have met with but a single specimen of this interesting species, the sculpture of which is so distinct that it cannot be confounded with any heretofore described (*Pse.*).

A. SEMISTRIATA Pease. Pl. 28, fig. 30.

Shell oval, contracted posteriorly, thin, fragile, pellucid, white, transverse raised lines at both ends; aperture slightly dilated at the base; apex perforate (*Pse.*).

Sandwich Is.

A. semistriata PSE., P. Z. S. 1860, p. 20.—SOWB., Conch. Icon. pl. 5, f. 27.—MARTENS & LANGK., Donum Bism., p. 53, pl. 3, f. 2.—COOKE, Ann. Mag. N. H. (5), xvii, p. 131.

This is identical with *A. ehrenbergi* Issel, a fossil from the Red Sea region, according to Cooke.

A. ALICULA A. Adams. Pl. 33, fig. 74.

Shell half an inch in length, subcylindrical, thin, the anterior and posterior ends transversely striated, hyaline; the under part brownish-white; outer lip not reflexed in the middle, with a single fold above, the other end rounded. Animal yellowish; the head and dilated sides of the foot light green; head rhomboid, subacute (*Ad.*).

Near Suez and Djedda, Red Sea (Mus. Cuming).

Bulla (*Atys*) *alicula* A. AD., Thes. p. 588, pl. 125, f. 126 (not *Alicula cylindrica* Ehrenb., = *Atys cylindrica* Helbl.).

This is not the *Alicula cylindrica* of Ehrenberg, which von Martens considers to be the species of Helbling, from an examination of the type now in the zoological museum of Berlin.

A. SUCCISA Ehrenberg. *Unfigured.*

Shell oblong-ovate, thin, transversely striate at both ends, white; lip uniplicate near its insertion in the concealed spire, the other

end truncated. Alt. 5, diam. 3 lines. There is the trace of a median gibbosity (*Ehrenb.*).

Djedda, Red Sea.

Bulla succisa EHRENB., Symb. Phys., *Bulla* no. 5.—COOKE, Ann. Mag. (5), xvii, p. 131.

May be a young *A. cylindrica.*

A. NONSCRIPTA A. Adams. Pl. 28, fig. 19.

Shell ovately cylindrical, white, subpellucid, longitudinally striated, posteriorly subtruncated, anteriorly produced; outer lip rather straight; inner lip anteriorly strongly truncated, ending in a tooth-like plait (*Ad.*).

B. (*Atys*) *nonscripta* AD., Thes. p. 588, pl. 125 f. 125.—*A. nonscripta* SOWB., C. Ic. f. 23.

A. ATTENUATA Sowerby. Pl. 28, figs. 26, 27.

Shell minute, narrow, white, thin; finely spirally striated at both ends; aperture narrow; outer lip subtruncated, columella oblique, subtortuous (*Ad.*).

Habitat unknown.

A. attenuata SOWB., C. Icon. t. 5, f. 29.

A. AMYGDALA Sowerby. Pl. 33, figs. 71, 72.

Shell subcylindrical, thin, dull white, concentrically finely striated near the ends; longitudinally striated, rather narrow towards the apex, rather inflated in the middle; aperture narrow; columella arched; outer lip raised, acuminated (*Sowb.*).

Habitat unknown.

A. amygdala SOWB., C. Icon. t. 2, f. 6 *a*, *b* (1869).

Resembling *Atys elongata*, it is yet, nevertheless, less cylindrical than that species, and is slightly striated in the longitudinal direction (*Sowb.*).

A. PORCELLANA Gould. Pl. 28, fig. 23.

Shell small, thin, ovate-cylindrical, milk-white, grooved with transverse striæ increasing toward the ends; apex funnel-shaped, imperforate. Aperture narrow, widened in front, the base subtruncate; columella deeply arcuate, subperforate, provided with a strong callus. Alt. 12, diam. 5 mill. (*Gld.*).

Kagosima Bay, Japan.

Atys porcellana GLD., Proc. Bost. Soc. N. H. vii, p. 138.—SOWB. (as of Guilding), Conch. Icon. f. 30.

Mr. Sowerby's mistakes in regard to the authority and localities of Gould's species have been corrected by E. A. Smith, Ann. and Mag. N. H. 1872, p. 345. It is not easy to see how so many errors could be made as occur in the later volumes of the Conchologia Iconica, even when it is understood that they were written without reference to the literature of the groups monographed.

A. LABIOSA Philippi. *Unfigured.*

Shell small, short, ovate, cylindric, very smooth, very delicately transversely striated at the base when viewed under a strong lens; spire retuse, whorls 2; aperture linear, dilated at base and uniplicate, continued above in a channel to the center of the vertex; margins of inner and outer lips thickened, obtuse. Alt. 1, diam. $\frac{2}{3}$ lines. (*Ph.*).

China (Largilliert).

Bulla labiosa PH., Zeitschr. f. Mal., 1851, p. 64.

The generic position is uncertain. An error (probably typographical) in Philippi's description has been corrected above.

A. TRANSLUCENS A. Adams. *Unfigured.*

Shell cylindric-ovate, thin, pellucid, transversely striated at the ends, the striæ distant, the median area glabrous. Aperture narrow; inner lip straight, truncated anteriorly; outer lip somewhat straightened in the middle, posteriorly twisted and produced, anteriorly crenulated (*Ad.*).

Port Hamilton, 10 fms.

Alicula translucens A. AD., Ann. Mag. N. H., (3), ix, p. 159.

This species most nearly resembles *Alicula succisa* Ehrenberg, from the Red Sea, but is narrower and more cylindrical in form, and is thin and nearly transparent. (*Ad.*).

A. SECALINA A. Adams. *Unfigured.*

Shell cylindric-ovate, rimate, the apex subtruncate and slightly perforated, semi-opaque, corneous, transversely striated throughout, striæ distant, obsolete in middle. Aperture linear; inner lip oblique, somewhat thickened; outer lip a little straightened in the middle. (*Ad.*).

Tsu-Sima, Japan, 25 fms.

Alicula secalina AD., Ann. Mag., (3), ix, p. 159.

This is a small, grain-like, horn-colored species, with the apex small and truncate, and the outer lip hardly produced beyond it. (*Ad.*).

A. VOLVULINA A. Adams. *Unfigured.*

Shell cylindric-ovate, rimate, acuminate and transversely striated at both ends, the striæ distant; white, thin, opaque, shining. Aperture narrow; inner lip obliquely flexuous, thickened in front; outer lip regularly arcuate. (*Ad.*).

Tsu-Sima, Japan, 26 fms.

Alicula volvulina AD., Ann. Mag. N. H., (3), ix, p. 159.

A little, white shining species, acuminate at both ends, like a *Volvula*, but with the sunken spire and twisted outer lip of an *Atys*. (*Ad.*).

A. EXIGUA A. Adams. Pl. 28, fig. 24.

Shell small, elongately oval, posteriorly narrowed, white, shining, longitudinally substriated, under the lens very minutely striated; aperture narrow, linear, anteriorly dilated; outer lip posteriorly produced, flexuous; inner lip subcallous. (*Ad.*).

Port Lincoln.

B. (*Atys*) *exigua* AD., Thes., p. 589, pl. 125, f. 129.—*A. exigua* SOWB., C. Ic., f. 19.

A. PARVULA A. Adams. Pl. 28, fig. 18.

Shell small, oval, white, shining, transversely entirely striated, striæ close together; outer lip arched, posteriorly produced, anteriorly dilated; inner lip slightly tortuous, subtruncated. (*Ad.*).

Port Lincoln.

B. (*Atys*) *parvula* AD., Thes., ii, p. 590, pl. 125, f. 130.—*A. parvula* SOWB., C. Ic., f. 25.

A. HORDEACEA A. Adams. Pl. 28, fig. 25.

Shell small, oval, white, shining, transversely strongly entirely striated, striæ rather wide apart; outer lip arched, posteriorly produced, anteriorly rounded; inner lip anteriorly strongly twisted, subtruncated. (*Ad.*).

Port Lincoln, Australia.

B. (*Atys*) *hordeacea* AD., Thes., p. 590, pl. 125, f. 131.—*A. hordacea* SOWB., C. Ic., t. 4, f. 20.

A. HYALINA Watson. Pl. 32, fig. 36.

Shell oval, subgibbous, a little abruptly contracted and slightly constricted and truncated above, striated, thin, hyaline, umbilicated, with a longish curved mouth. Sculpture: Longitudinals—there are very many slight equal hair-like lines of growth. Spirals—with the exception of a narrow, nearly medial band which is smooth, the whole surface is scratched with fine, smooth, regular, square-cut, widely parted furrows. These are rather more regularly arranged above than below, where the interstices are more wide and less regular; but toward the end of the shell in both directions the furrows tend to become crowded; they extend to the very edge of the funnel-shaped depression of the apex; but the depression itself is smooth, except for the twisted edge of the outer lip, which at the generic sinus is reverted as usual, but somewhat narrowly; in front they score the umbilicus on one side, but do not quite extend to the edge of the pillar. Colour hyaline to translucent. Mouth long, curved, rather narrow, and not much enlarged in front. Outer lip convex, posteriorly produced; the generic twisted sinus is rather small, above it the lip rises and advances, and forms a sharp curve, from this point the lip runs out to the right, at first straight or faintly concave, and here a little contracted, but afterwards with a very regular curve, and increasingly patulous to the point of the shell. Top very obliquely truncate, with a bluntish edge and a small funnel-shaped depression, which, through the generic sinus leads into the interior of the shell. Inner lip: there is no glaze on the body, the curve of which is a little gibbous above; the pillar edge is narrow, reverted, bluntly toothed, twisted and truncated in front; at the top of the pillar this edge is very much twisted, and is there separated from the body, leaving a very narrow but deep fissure communicating with the deep umbilicus which lies behind, and is partly covered by the expanded and projecting pillar edge. Alt. 0·44 in. diam. 0·24. Breadth of mouth at same place, 0·07 inch (*Wats.*).

Levuka, Fiji, 12 fms.; *Wednesday Island and near Cape York, N. Australia*, 6–8 fms.

Atys hyalina WATS., Chall. Gastr. p. 640, pl. 48, f. 1.

I do not know any *Atys* with which to compare this very beautiful and delicate species. It has something of the gibbosity of *Atys cylindrica* (Helb.), var. *solida*, in its stumpiest forms; but the texture of the shell, the sculpture, and the umbilicus, are very differ-

ent. The specimens from Stations 186 and 187 are quite young shells, but are, I have no doubt, this species. From Honolulu, 40 fathoms, there is a specimen of *Atys* probably belonging to this species, but in too bad condition for identification with any certainty.

A. DARNLEYENSIS Brazier. *Unfigured.*

Shell elongately oval, rather thin, shining, white, attenuated and umbilicated at both ends, longitudinally obliquely plicated, strongly transversely striated at each end, the centre or intermediate space with fine irregular waved striæ, sometimes straight; outer lip thickened within, nearly straight posteriorly, slightly twisted and produced; inner lip at the anterior end forming a thin callous ridge at the side of the umbilicus, slightly reflected, and ending in a denticform plate. Length 6½ lines, breadth 3 lines (*Braz.*).

Darnley Island, Torres Straits, 30 fathoms.

A. darnleyensis BRAZ., P. L. S. N. S. W. ii, p. 85, 1877.

A. CHEVERTI Brazier. *Unfigured.*

Shell subcylindrical, white, thin, transparent, smooth and inflated in the middle, transversely striated at both ends, the upper striæ extending nearly to the centre; aperture narrowly linear, wide below, outer lip slightly twisted and posteriorly produced, inflected and angled in the centre; inner lip anteriorly, with a strong fold. Length 3 lines, breadth 1½ lines (*Braz.*).

Darnley Island, Torres Straits, 30 fathoms; *Cape Grenville, North East Australia*, 20 fathoms.

A. cheverti BRAZ., P. L. S. N. S. W. ii, p. 86, 1877.

This species is like a miniature *Atys elongata*. Some specimens have an opaque appearance at the back of the aperture, others very thin and transparent (*Braz.*).

A. PULCHRA Brazier. *Unfigured.*

Shell cylindrical, white, thin (under the lens) longitudinally closely plicated, and transversely very finely striated, giving the shell a rugose appearance, very minutely umbilicated at both ends, aperture rather narrow, wide below; outer lip thin, reflected inside, slightly posteriorly produced; columella with a slight curve, minutely expanded and reflected, leaving half the umbilicus covered. Length 3 lines, breadth 1½ lines (*Braz.*).

Darnley Island, Torres Straits, 30 fathoms.

A. pulchra Braz., P. L. S. N. S. W. ii, p. 86, 1877.

A pretty little species, having the whole surface of a rugose appearance, the transverse sculpture being quite distinct. In some specimens the columella is sometimes straight and not curved.

A. densa Brazier. *Unfigured.*

Small, oval, thick, dirty white shell, finely plicated, strongly transversely striated; interstices with finer lines (as seen under the lens); aperture narrow, wide below; outer lip regularly arched, posteriorly produced, anteriorly twisted and produced, partly covering the umbilicus. Length 2 lines, breadth 1¼ lines (*Braz.*).

Darnley Island, Torres Straits, 30 fathoms.

A. densa Braz., P. L. S. N. S. W. ii, p. 86, 1877.

A. dubiosa Brazier. *Unfigured.*

Shell small, oval, white, thin, shining, umbilicated at both ends, the one at the base the largest, transversely very finely striated at each end (scarcely visible under the lens), more distinct at the base, intermediate space smooth, ventricose above the centre; aperture narrow, outer lip angled, posteriorly slightly thickened and produced, below straight; columella with a single obsolete plait at the base. Length 2 lines, breadth 1¼ lines (*Braz.*).

Darnley Island, Torres Straits, 30 fathoms.

A. dubiosa Braz., P. L. S. N. S. W. ii, p. 86, 1877.

A. m'andrewii Smith. *Unfigured.*

Shell elongate-ovate, truncated above, pellucid, *encircled by numerous narrow milky bands*, one in the middle wider; transversely distantly striated at top and base, the interstice smooth; vertex excavated, bounded by an acute margin. Aperture narrow, produced a little above the vertex, a little dilated and effuse at the base; lip thin, inserted in the middle of the vertex and sinuated there; columella short, thickened, hardly twisted; umbilical region slightly perforated. Alt. 5, diam. 2½ mill. (*S.*).

Lancerote, Canaries.

A. m'andrewii E. A. S., Ann. Mag. N. H. (4), ix, p. 346.

It is at once recognized by the numerous lacteous bands upon a pellucid ground.

A. canariensis Smith. *Unfigured.*

Shell ovate, white, pellucid, striated with irregular growth lines, and transversely deeply striated above and below, lightly so in the

middle; vertex depressed; aperture moderately narrow above, produced a little above the vertex, dilated somewhat toward the base; lip thin, thickened toward the middle of the vertex; columella arcuate, a little reflexed; umbilical region distinctly perforated. Alt. 7, diam. 4½ mill. (*S.*).

Teneriffe, Canary Is.

A. canariensis E. A. S., Ann. Mag. N. H. (4), ix, p. 346.

Of the form of the young state of *A. naucum;* but the striæ are less distinct and not so far apart; also very like *caribaea* D'Orb., but rather broader (*S.*).

A. CARIBÆA Orbigny. Pl. 48, fig. 12; Pl. 28, figs. 33, 34.

Shell oval, oblong, thin, fragile, smooth, attenuated and transversely striated at both ends; spire entirely concealed, marked by an imperforate umbilical depression; aperture narrow, a little arcuate, wider in front; columella acute, a little separated by an umbilical depression. Color uniform white. Alt. 5, diam. 2 mill. (*Orb.*).

Martinique, Jamaica, Guadeloupe, St. Thomas, Cuba.

Bulla caribœa ORB., Moll. Cuba, i, p. 127, pl. 4, f. 21–24.

Orbigny's description and figure, given above, are not good. The species is better represented by fig. 12 of pl. 48.

The shell is oblong, varying somewhat in length, somewhat more compressed above than below, marked by widely spaced spiral grooves above and below, these grooves becoming closer and deeper toward the ends. From the center of the narrow, concave vertex rises the distinctly plicate lip. The columella is vertical, thickened but not toothed in the middle, the edge reflexed, partly concealing the narrow but distinct umbilicus. Alt. 10, diam. nearly 5 mill.

Not having seen the types of the two species following, I am unable to say whether they are forms of this one or deserving of specific rank.

A. GUILDINII Sowerby. Pl. 28, fig. 46.

Shell ovate, thin, dull grayish-white, attenuated posteriorly, spirally striated near the ends, slightly longitudinally wrinkled, ventricose below the centre, slightly umbilicated at each end; outer lip elevated above; subacuminated, inflected; columella thin, rather straight (*Sowb.*).

This species is one of the very few in the genus *Atys* which presents the character of possessing longitudinal wrinkles or striæ (*Sowb.*).

St. Vincent, West Indies.

A. guildinii SOWB., Conch. Icon. xvii, pl. 5, f. 26.

Seems more pyriform than *A. caribæa.* Sowerby probably intended the name as an allusion to that clear-seeing pioneer, GUILDING; but in this case, as in so many others throughout his monograph, the performance fell short of the good intention.

A. SPECIOSA A. Adams. Pl. 28, fig. 42.

Shell oval, perforated, posteriorly narrowed and subtruncated, anteriorly rounded and ventricose, white, semiopaque, shining, longitudinally superiorly strongly striated, inferior striæ evanescent, transversely striated at both ends; outer lip thickened within, posteriorly twisted, with a single plait; inner lip reflexed, anteriorly semiplicated (*Ad.*).

Habitat unknown.

B. (*A.*) *speciosa* A. AD., Thes. p. 587, pl. 125, f. 122.—SOWB., C. Icon. t. 3, f. 14.

A. RIISEANA Dunker. *Unfigured.*

Allied to *Bulla cylindrica* Helbl., but much smaller. Alt. 10½, diam. 5 mill. (*Mörch*).

St. Thomas (Riise, Ravn.); *St. Martin; New Providence; Trinidad; Anguilla; Porto Plata* (Krebs).

Atys riiseana Dkr., *MSS.*, MORCH., Mal. Bl. xxii, p. 173.

This does not seem to be different from *A. caribæa.*

A. SANDERSONI Dall. Pl. 28, fig. 47.

Shell small, thin, fragile, polished, translucent-white, with the aperture longer than the axis of the shell, slender, elongated oval with the posterior fourth bevelled off slightly; transverse sculpture solely of delicate evanescent lines of growth, sometimes lost in the general polish of the surface; spiral sculpture of about a dozen incised lines near either extremity, more crowded toward the tips and obsolete toward the middle of the shell, reticulating the lines of growth when the latter are present, but delicate, extremely fine, and not puncticulate; posterior apex a rather deep funiculate pit, from the center of which rises the margin of the aperture, which is here slightly reflected, extends behind the summit of the body and suddenly curves forward, leaving a very narrow aperture, which is produced into a rounded point in front, then sharply recurved and reflected to a point where the reflected part loses itself in the thin callus on the body within the aperture; the anterior reflection is

sometimes closely appressed and sometimes loose with a chink behind it, but there is no anterior pit; the shell is more slender forward than behind, the bevelling is more marked in some specimens than in others a fragment from off Havana, if conspecific, as seems likely, indicates that it reaches a much larger size than the described specimens. Lon. of shell and aperture, 6·5. Max. lat. of shell, 3·4, of aperture 1·75 mill.; lat. of aperture 0·5 mill. (*Dall*).

Off Bahia Honda, Cuba, 220 fms.; *Near Santa Cruz*, 38 fms.

Atys ? sandersoni DALL., Bull. M. C. Z. ix, p. 99, 1881; Blake Gastr. p. 54, pl. 17, f. 7.

A. CASTA Carpenter. *Unfigured.*

Shell elongated, thin, subdiaphanous, whitish; a little more swollen anteriorly; spire concealed, lacunate, in adult shells hardly umbilicated; columella a little intorted, effuse; umbilicus small; lip produced posteriorly, obtusely angulated; entire surface subtly spirally striatulate. Alt. .4, diam. ·18 inch (*Cpr.*).

Cape St. Lucas.

? Atys casta CPR., Ann. Mag. N. H. (3), xiii, p. 314, 1864; Moll. Western N. A. p. 104, 212.

On the confines of the genus related to *Cylichna* (*Cpr.*).

Subgenus DINIA H. & A. Ads., 1854.

A. DENTIFERA A. Adams. Pl. 27, fig. 81.

Shell ovoid, posteriorly subtruncated, anteriorly produced, horny, pellucid, longitudinally sulcated; outer lip simple, acute; inner lip anteriorly strongly truncated, ending in a dentiform plate (*Ad.*).

Lord Hood's Island (Cuming); *Suez* (Cooke); *Mauritius* (Mart.); *Levuka, Fiji* (Challenger).

Bulla (*Atys*) *dentifera* AD., Thes. p. 588, pl. 125, f. 124.—*A. dentifera* SOWB., C. Icon. t. 2, f. 13.—COOKE, Ann. Mag. N. H. (5), xvii, p. 133.—MARTENS, Meeres-fauna Maurit. p. 303.—*Atys* (*Dinia*) *dentifera* ADS., Genera, ii, p. 21.—WATSON, Chall. Rep. p. 641.

A. MONODONTA A. Adams. Pl. 28, fig. 17.

Shell subcylindrical, posteriorly subtruncated, anteriorly produced, solid, opaque, longitudinally grooved; outer lip inflexed in the middle; inner lip strongly truncated anteriorly, and ending in a dentiform plate (*Ad.*).

Shores of Borneo (Cuming).

B. (*A.*) *monodonta* A. AD., Thes. p. 588, pl. 125, f. 123.—SOWB., Conch. Icon. pl. 2, f. 12.

A. MIRANDA Smith. *Unfigured.*

Shell elongate-ovate, pellucid, transversely delicately striated and with irregular growth lines; vertex depressed, perforated in the middle, whence the outer lip rises. Aperture very narrow above, rising little above the vertex, sensibly dilated and effuse toward the base; columella very short, arcuate, abruptly truncated (as in the genus *Achatina*). Alt. 10, diam. 4 mill. (*S.*)

Gulf of Suez.

A. miranda E. A. S., Ann. Mag. N. H. (4), ix, p. 347.

R. JEFFREYSI Weinkauff. Pl. 59, figs. 1, 2.

The obese-cylindrical shell is truncated above and below, narrowly umbilicated above; under the lens fine striæ are visible on the upper and lower parts, becoming indistinct in the middle. The aperture is narrow, the margin projecting above, scarcely arcuate, and very little dilated below; columella but little thickened. The shell is thin, translucent, yellow-greenish, smooth and covered with very fine growth striæ. Alt. 8, diam. 3½ mill. (*Weink.*).

Piedmont Coast; Sicily; Algeria; Provence.

Bulla ovulata Broc., JEFFREYS, Ann. Mag. N. H. (2), xvii, p. 188, pl. 2, f. 18, 19, 1856. Not *B. ovulata* Brocchi, Conch. Foss. Subapp., 1814.—*Cylichna jeffreysi* WEINK., Journ. de Conch. xiv, 1866, p. 238; Conch. des Mittlm. ii, p. 199.—*Roxaniella jeffreysi* MONTS., Nom. Gen. e Spec. p. 144.

R. BROCCHII Michelotti. Pl. 59, fig. 3; pl. 28, fig. 45.

Shell cylindric-oblong, hyaline, sculptured with very fine spiral striæ, invisible to the naked eye; apex obtuse, umbilicated; columella obsoletely uniplicate below (*Phil.*).

Alt. 5 lines, diam. slightly less than 2 (*Brocchi*).

Sicilian Coast (Phil.); *Adria-Zara* (Sandri); *Algeria* (Weink.).

Bulla ovulata BROCCHI, Conch. Foss. Subapp. p. 277, pl. 1, f. 8 (not *B. ovulata* Lam., Ann. du Mus. 1801).—A. AD., Thes. Conch. ii, p. 586, pl. 125, f. 118.—PHIL., Enum. Moll. Sicil. i, p. 122.—*B. brocchii* MICH., Foss. Mioc. de l'It., p. 151.—*Cylichna brocchii* WEINK., Conch. des Mittelm. ii, p. 200.

The figure on pl. 59 is copied from the original illustration. Fig. 45 of pl. 28 is from Sowerby. See Weinkauff for references to the palæontological literature of the species.

A. DIAPHANA Aradas. Pl. 32, figs. 29, 30.

Shell ovate, turgid, very shining, hyaline, smooth in the middle, sculptured with about 10 flexuous, concentric striæ above and below, becoming closer toward each end; vertex subtruncate, umbilicate, thickened at the outer margin. Aperture coarctate in the middle, patulous and angled above, canaliculate below; columella with one fold at base. Alt. nearly one-fifth, width one-tenth inch (*Jeffr.*).

Ægean Sea to Italy.

Bulla diaphana ARAD., Catal. Rag., etc., p. 40 (1840).—PHIL., Enum. Moll. Sicil. ii, p. 215.—*Weinkauffia diaphana* MONTS., Nom. Gen. e Spec. p. 145.—*Bulla turgidula* FORBES, Rep. Aeg. Invert. p. 188, (1843).—*Bulla semistriata* REQ., Coq. de Corse, p. 42 (1848).—*Scaphander gibbulus* JEFFR., Ann. Mag. N. H. (2), xvii, 1856, p. 188, pl. 2, f. 20, 21.—SOWB., Conch. Icon. xviii, f. 8.

According to Monterosato it varies in being more or less swollen.

A. BLAINVILLIANA Recluz. Pl. 43, fig. 16.

Shell oblong, subcylindrical, umbilicated, shining, milk-white; a little convex in the middle, very smooth, striated at the ends, the marginal striæ deeper, the others sensibly smoother. Aperture oblong, wider at base; columella obtusely one-toothed below. Alt. 10, diam. 5½ mill. (*Récl.*).

Coast of Provence and of Sicily (Récl.).

Ovula triticea BLAINV., in Faune Française, ou Hist. Nat., Gén. et Partic. des Anim. que se trouv. en France, Moll., p. 251, pl. 9 A, f. 4 (good); not of Lam. nor Payr.—*Bulla blainvilliana* RECLUZ, Rev. Zoologique la Soc. Cuvierienne, 1843, p. 10.—*Cylichna blainvilleana* Récl., LOCARD, Coq. Mar. Fr., p. 27.—*C. jeffreysi* LOCARD, Prodr., p. 75.

The apex is umbilicated, the umbilicus being a millimetre in width and rounded within; the umbilicated end is a little more attenuated than the base of the shell. This species is a real Bulla and not an Ovula, always of a beautiful whiteness, not red-orange (*Récl.*).

The description of this shell in Faune Française is partly hypothetical, the author of that work being under the impression that his shell was a dead specimen of a red *Ovula*, described and figured by Payraudeau. Récluz has also given a very poor description (translated above), but his citation of Blainville's figure as a good

representation of his species, is sufficient to fix its identity beyond doubt. Compare *A. diaphana* Arad.

Subgenus Roxania Leach, 1847.

For anatomy see under *Atys*.

A. utriculus Brocchi. Pl. 28, figs. 28, 29.

Shell oval, with a tendency to become cylindrical, rather solid, semitransparent and glossy . sculpture, numerous spiral striæ or impressed lines, which are visible to the naked eye ; towards each end they are stronger, and alternately large and small (sometimes two or three smaller striæ between two of the larger size), and they are throughout closely punctate in consequence of the interstices being crossed by fine longitudinal striæ ; the spiral striæ are much slighter in the middle of the shell, which in the young is usually quite smooth ; epidermis reddish-brown, it is chiefly persistent on the spiral striæ, which are, therefore, darkly lineated ; color pale yellowish or cream color, occasionally milk-white ; spire partly exposed ; crown perforated, and obliquely encircled by a thick angular rim ; mouth as in *H. navicula*, but narrower, its length exceeds that of the spire ; outer lip not much curved in the middle, nor folding inwards ; it projects a little beyond the crown ; inner lip slight ; pillar short, thick, and flexuous ; at its base is a rather strong fold, which makes the lower part of the mouth appear channelled ; behind the pillar is a small and groove-like umbilicus (*Jeffr.*). Alt. 12, diam. 7½ mill.

Var. *oblonga*. Smaller, longer in proportion to its breadth, and more cylindrical (*Jeffr.*).

Finmark to the Canary Is. ; Mediterranean Sea.

Bulla utriculus Brocchi, Conch. Foss. Subap. i, p. 633, pl. 1, f. 6.—*Bulla utriculus* Jeffr., Brit. Conch. iv, p. 440 ; v, pl. 95, f. 4. —*Bulla cranchii* Leach, in Flemings' Brit. An. p. 292.—Forbes & Hanley, Hist. Brit. Moll. iii, p. 533, pl. 104, f. 8, 9, and pl. VV, f. 2 (animal).—*Atys cranchii* Ad., in Thes. ii, p. 586, pl. 125, f. 115.—Sowb., in Conch. Icon. pl. 1, f. 9.—*Bulla punctura* Johnson, Edinb. New Philos. Journ. 1828, p. 79.—*Roxania utriculus* Monts., Nom. Gen. e Spec. p. 145.—*Bulla intermedia* Aradas.

A. punctulata A. Adams. *Unfigured.*

Shell ovoid, solid, perforate, rounded at each end, decussate striate, transversely profoundly sulcate, the sulci strongly punctate.

Aperture narrow, dilated in front; inner lip straight, truncated below; outer lip produced behind, rounded (*Ad.*).

Mino-Sima, Japan, 63 fms.

Roxania punctulata Ad., Ann. Mag. N. H. (3), ix, p. 158.

No species hitherto described resembles this; the nearest approach to it is *R. cranchii* Leach. *R. insculpta* Totten is sculptured rather like it. The shell is solid, very strongly punctate-striate, and deeply umbilicated, and the inner lip is truncate anteriorly (*Ad.*).

Genus DIAPHANA Brown, 1837.

Diaphana Brown, Conchologist's Text Book, 4th edit., p. 98 (type *D. candida* Brown = *Retusa minuta* Brown, 1827).—Sars, Moll. Reg. Arct. Norv. p. 288.—*Amphisphyra* Loven Ofversigt Kongl. Vet. Akad. Förhandl. 1846, p. 142 (*A. globosa* Lov. and *A. pellucida* Brown).—*Utriculus* (in part) of Brown, Jeffreys, Sowerby, et al.—*Physema* H. & A. Ad., Gen. Rec. Moll. ii, p. 21, type *D. hiemalis*.

Shell thin and fragile, capacious or subglobose, umbilicated, the spire either projecting, flat, or sunken in a narrow apical umbilicus. Aperture narrowed above, rounded below, the lip sinuous; columella not thickened, long and rather straight, neither folded nor truncated, its edge a little reflexed above. Type *D. minuta* Brown.

Animal (pl. 61, fig. 22, *D. expansa*) capable of being contained in the shell; frontal disc small, produced in two conical processes at the anterior angles; eyes present or wanting; epipodial lobes apparently wanting; foot auriculate at the anterior angles, split into two triangular tails behind. No stomach plates.

Radula short, with the formula 1.1.1. Central teeth are delicate, erect, oblong laminæ, with bilobed and closely serrate upper margins; laterals are large and falcate, the long, rather straight, obtuse cusps crossing above the centrals; uncini wanting (pl. 61, figs. 20, 21, *D. minuta*).

Distribution, mainly North Atlantic.

Capt. Brown seems to have included the species of this genus at first in *Retusa*, then in *Diaphana*, and finally in *Utriculus*. I have not seen the first edition of the "Conchologist's Text Book," issued in 1833, and do not know whether *Diaphana* was published at that time or not. It appears, properly defined, in the fourth edition, 1837; but in 1844 Brown places the species under *Utriculus* as a

second section of that genus. *Utriculus* is, however, a mere synonym for *Retusa*, which Brown proposed as a substitute for his own earlier name.

The genus differs from *Retusa* in possessing a radula, in the absence of stomach plates, etc. The shell is more globose and fragile than in *Retusa* or *Cylichna*, with a larger umbilicus, thin columella and without distinct sculpture. The lack of epipodial lobes and of uncini also distinguishes this genus.

D. DEBILIS Gould. Pl. 59, fig. 27.

Shell thin, fragile and somewhat transparent, light brownish corneous, irregularly ovate, broadly globose below, narrow and subangular above. Apex large, globose, obliquely and mamillarly projecting; subsequent whorls 2½, the inner very narrow; convex, planorboid, separated by deep sutures, the latter part of the last whorl somewhat descending. Body-whorl compressed above, swollen below, very lightly sculptured with indistinct growth-lines. Aperture nearly as long as the shell, narrow and biangular above, broadly rounded below; outer lip thin and sinuous; columella long and nearly straight, not thickened, the edge somewhat reflexed above, partly closing the narrow umbilicus.

Alt. 3½, diam. 2½ mill.

Greenland to Connecticut.

Bulla debilis GLD., Amer. Journ. Science xxxviii, p. 196 (1840); Otia Conch., p. 179; Invert. Mass., p. 164, f. 951.—DEKAY, N. Y. Moll. p. 17, pl. 35, f. 329.—*Bulla* (*Aplustrum*) *debile* AD., Thes. Conch., p. 564, pl. 120, f. 8.—*Aplustrum debile* SOWB., Conch. Icon. f. 3.—*Diaphana debilis* STIMPSON Check-Lists, p. 4;—W. G. BINN. in Invert. Mass., p. 216, f. 507.—LECHE, Kongl. Svensk. Vet.-Akad. Handlingar, 1878, p. 71.—*Akera subangulata* MOLLER, Ind. Moll. Groenl., p. 6. SOWB., C. Icon. xvi, f. 1.

I have retained this species separate from *D. hyalina* because in the specimens before me the apex projects as in *D. seguenzæ*, which does not seem to be the case with Scandinavian specimens of *hyalina*.

D. LOTTÆ Bush. Pl. 59, figs. 32, 33.

Shell rather large, short and stout, abruptly tapered at the ends, truncate at the top with the two whorls of the spire showing in a shallow pit; translucent, yellowish-white, with a slightly lustrous

surface covered with distinct punctate spiral lines. The outer lip rises considerably above the level of the body whorl, arches well forward, and follows the curvature of the body whorl to near the base, where it is a little expanded, and joins the columella in a broad curve. The inner lip is formed by a rather wide, closely adhering layer of enamel, which is considerably thickened on the columella, spreading out over the umbilical region with a thick, free outer edge. The spiral lines are distinct and rather coarsely punctate, a little crowded on the apex of the shell, nearly uniformly separated to just below the centre (five to the millimeter), where there are two quite fine, widely separated ones, below which they become again coarser and considerably crowded on the base. Epidermis thin, very slightly tinged with yellow. Lines of growth inconspicuous.

Length of shell, 8 mill.; breadth, 5·5 mm.; length of aperture 8·5 mill. (*Bush*).

Off Cape Lookout, N. C., in 603 fms.

Diaphana (*?*) *lottæ* Bush, Bull. M. C. Z. xxiii, p. 222, pl. 2, f. 8, 9.

A smaller, somewhat worn specimen (No. 45,604), differing from the above only in having fewer spiral lines, was dredged by the U. S. F. C. in 1882, at Station 1142, off Martha's Vineyard, in 322 fathoms.

This species bears considerable resemblance to *Cylichna occulta* Migh. & Ad.; but that is a much smaller and more slender species, more gradually tapered toward the ends, with finer and more numerous spiral lines.

D. seguenzæ Watson. Pl. 26, figs. 76, 77.

Shell small, oval, glossy, finely spirally stippled, with the large open mouth and simple lips of a Bulla, but with a small prominent mamillate apex. Sculpture: Longitudinals—there are over the whole surface fine close lines of growth. Spirals—there are fine sharp lines made of minute round stippled dots; above, these lines are crowded, in the middle they are sparse, towards the point they are again closer. Colour semi-translucent white, with a greyish surface. Spire very short and blunt, sometimes not raised at all. Apex a small but coarse, slightly prominent, mamillate tip. Suture impressed. Mouth resembling that of a *Bulla* and shaped like a long bent pear. Outer lip rises slightly above the body, sometimes to a

level with the tip, retreats above and below, and is roundly prominent in the middle, where it slightly bends inwards, elsewhere it is patulous; its sweep is very regular throughout. Inner lip roundly curved on the body, rather deeply concave at the top of the pillar, along which it runs nearly straight; a broad pad with defined edge spreads across the body, and is pretty broad and reverted on the pillar with a very slight twist on its front edge and a minute umbilical chink behind; the lip is not emarginate in front.

Length 0·15 diam. 0·1. Greatest breadth of mouth in front, 0·05 inch. (*Wats.*).

Off Pernambuco, 350 fms.; *West of Azores*, 1000 fms. (Watson). *Middle Pliocene of Calabria* (Seguenza).

Bullina undata Chiaje, Seguenza, Form. Terz. Calabria, p. 251, pl. 16, f. 9 (Not of Chiaje).—*Amphisphyra seguenzæ* Watson, Chall. Gastr., p. 641, pl. 48, f. 5.

D. minuta Brown. Pl. 26, figs. 70, 71.

Shell very thin and fragile, hyaline, cylindric-ovate, dilated in the middle, the base obliquely rounded; vertex narrower, truncated and depressed, spirally involute. Whorls 3-4, separated by a distinctly impressed suture. Aperture shorter than the last whorl, quite ample below; outer lip flexuous, obtusely rounded at the upper angle, slightly inflexed above the middle, roundly expanded beneath; columella short, slightly flexuous; umbilicus narrow, chink-shaped.

Alt. 5 mill. (*Sars.*).

Scandinavia and British Is., south to Kiel Bay; Ocean coast of France; Madeira and Canary Is.; Palermo; Naples.

Bulla hyalina Turton, Mag. Nat. Hist. vii, p. 353. Not *Bulla hyalina* Gmel.—*Amphisphyra hyalina* Loven, Ind. Moll. Skand. Meyer & Mobius, Fauna Kieler Bucht i, p. 67, f. 8, 9 (shell).—Forbes & Hanley, Hist. Brit. Moll. iii, p. 521, pl. 114D, f. 1, 2 (shell) and pl. UU, f. 2 (animal).—Monts., Journ. de Conch. 1874, p. 280.—Locard Coq. Mar. Fr. p. 29, f. 15.—*Utriculus hyalinus* Jeffr., Brit. Conch. iv, p. 428; v, pl. 94, f. 7; Ann. Mag. N. H. (4), xix, p. 335.—*Diaphana hyalina* Sars, Moll. Reg. Arct. Norv., p. 289, pl. 18, f. 1 (shell); pl. xi, f. 10 (dentition).—*Utriculus minutus* Brown, Ill. Conch. G. B., (edit., 1844), p. 58, pl. 19, f. 7, 8 (very young shell).—*U. pellucidus* Brown, *t. c.*, p. 59, pl. 19, f. 10, 11.—Sowb., Conch. Icon. xviii, fig. 1.—*U. candidus* Brown, *t. c.*, p. 59,

pl. 19, f. 13, 14.—*Diaphana candida* BROWN, Conch. Text Book, p. 98, pl. 14, f. 30.

This species has generally been known by the preoccupied name *B. hyalina* Turton, which is, besides, later than the names given by Brown.

D. EXPANSA Jeffreys. Pl. 26, fig. 69.

Shell very thin, hyaline, irregularly ovate, quite ventricose, the width nearly equal to the alt.; base obliquely expanded; vertex narrow, truncate, spirally involute; whorls 3–4, the penultimate slightly projecting. Aperture narrow above and removed from the vertex, very much expanded below; outer lip narrowly rounded at the superior angle, then slightly inflexed, beneath obliquely arcuate; columella nearly straight; umbilicus narrow but distinct.

Alt. 6 mill.

Shetland Is.; Norway; Bay of Biscay; Palermo.

Amphisphyra expansa JEFFR., Rep. Brit. Asso. 1864, p. 330.—MONTS., Journ. de Conch. 1874, p. 280.—*Utriculus expansus* JEFFR., Brit. Conch. iv, p. 426; v, pl. 94, f. 6; Ann. Mag. N. H. (6), vi, p. 318.—? *Bulla globosa* CANTRAINE, Mal. Méd. et Lit. p. 82, (ex. Mém. Acad. Roy. Bruxelles, xiii).—*Diaphana expansa* SARS, Moll. Reg. Arct. Norv., p. 289, pl. 18, f. 2a (shell), 2b (animal) and pl. xi, f. 11 (dentition).

Shell more inflated, less angular in the middle than *D. minuta*, with a larger umbilicus. The animal lacks eyes, and the foot is narrower and longer than in *D. globosa*.

D. QUADRATA Monterosato. *Unfigured.*

Small, wider than high, very fragile, transparent and without any sort of sculpture; spire truncated, composed of 3 convex whorls, angular at the lower part, and separated by an excavated suture. Aperture nearly squared, the outer margin detached at the insertion as in the genus *Akera;* columella perpendicular, umbilicus profound.

Off Cape St. Vito, and Palermo, Sicily, in deep water.

Amphisphyra quadrata MONTS., Journ. de Conchyl., 1874, p. 280.

D. VENTRICOSA Jeffreys. Pl. 59, figs. 29, 30, 31.

Shell globosely ear-shaped (not like a *Velutina*), nearly transparent, glossy and slightly prismatic; sculpture, numerous fine,

curved, minute longitudinal striæ, which are very closely set on the upper edge of the body whorl; these striæ are crossed by a few indistinct spiral lines, but not so as to make the surface reticulated; epidermis inconspicuous. Color whitish, with a faint tinge of reddish-brown near the outer lip, spire small, truncated and flat; whorls 3, slightly angulated at the top; the last is disproportionately large, and the first or central whorl is oval and intorted; suture very deep and channelled, mouth expanded, nearly oval, contracted above by the projection of the periphery; base even and curved, outer lip semicircular; the upper part is on a level with the spire; outer corner rounded, inner corner not receding nor incurved, as in *R. obtusa*, (but my solitary specimen is imperfect in this part); inner lip forming a whitish film, which is spread over the upper part of the under side, it is folded over the pillar, behind which it forms a narrow umbilical groove; pillar slight and curved, fold obscure. Length 0·125, breadth 0·1 inch. (*Jeffr.*).

Amphisphyra globosa JEFFR., Ann. Mag. N. H., (3), i, p. 47, pl. 2, f. 6. Not of Lovén.—*Amphisphyra ventricosa* JEFFR., Rep. Brit. Asso., 1864, p. 332.—*Utriculus ventrosus* JEFFR., Brit. Conch., iv, p. 425; v, pl. 94, f. 5, (1867).

Sars thinks that this may be the same as *Philine velutinoides*. The soft parts are still unknown.

Mr. Barlee procured a single specimen by dredging off Glenelg n Skye; this is now in my collection. I tried the same ground with Mr. Norman last year, in the hope of confirming the discovery, but we were unsuccessful. Its nearest ally appears to be the *Amphisphyra globosa* of Lovén (a Scandinavian species). Our shell, however, is ear-shaped, instead of globosely oval, the spire is proportionately broader, the mouth much wider, and the sculpture peculiar, *U. globosus* exhibiting only the lines of growth. (*Jeffr.*).

D. DENSESTRIATA Leche. Pl. 26, figs. 72, 73, 74.

Shell external, inflated, subglobose, rather solid, pellucid, with very close, impressed longitudinal striæ; spire concealed, the apex perforated; aperture ample, rounded but not dilated in front, narrow behind, extending above the spire; lip acute, arcuate, produced behind; columella sinuate-arcuate, covered with a strong callus. Alt. 6, diam. 4 mill. (*Leche*).

Karisch Sea, 9–70 fms.

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Utriculopsis densistriata LECHE, Kongl. Sv. Vet. Akad. Handl., xvi, p. 74, pl. 1, f. 20, *a*, *b*, *c* (shell), f. 20 *d* (dentition), 1878.—*Diaphana densistriata* AURIVILLIUS, Vega Exped. Vetenskap. Iakttagelser, iv, p. 371.

D. GLOBOSA Lovén. Pl. 26, fig. 75.

Shell very thin, vitreous, subglobose; base obliquely rounded; vertex narrowly truncated, narrowly perforated, the spire nearly concealed. Aperture as long as the shell, narrow and supine above, expanded below; outer lip produced above the vertex and subangulate, obliquely arcuate below; columella flexuous; umbilicus distinct. Alt. 4 mill. (*Sars*). *Scandinavia.*

Amphisphyra globosa LOVEN, Ind. Moll. Scand., p. 11 (Ofv. Kongl. Vet. Akad., 1846, p. 143).—*Diaphana globosa* SARS, Moll. Reg. Arct. Norv., p. 290, pl. 18, f. 4 (shell), f. 3 *c* (animal); pl. xi, f. 12 (dentition).—*Utriculus globosus* SOWB., Conch. Icon., xviii, f. 2.—*Utriculopsis vitrea* M. SARS, Bidrag til Kundskab Christianiafjordens Fauna, ii, p. 65, pl. 11, f. 16–18 (shell only; not f. 15, animal, which is *Philine vitrea*, q. v).

D. HIEMALIS Couthouy. Pl. 59, fig. 28.

Shell minute, globose, thin and fragile, subtranslucent, horn colored; body whorl very convex, widest in the middle, narrowly truncated at the vertex, which shows a minute umbilical perforation. Aperture narrow above, rising well above the vertex, broad below; outer lip strongly sinuous, receding toward the upper insertion, rising high above the vertex of the body of the shell; columella long, thin, slightly sinuous, partially closing the narrow umbilicus. Alt. 2½, diam. 2 mill.

Maine to Massachusetts Bay; Scandinavia.

Bulla hiemalis COUTH., Bost. Journ. Nat. Hist., ii, p. 180, pl. 4, f. 5.—DEKAY, N. Y., Moll., p. 18, pl. 35, f. 335.—GLD., Inv. Mass., p. 163, f. 100.—*Diaphana hiemalis* STIMPSON, Check-Lists, p. 4.—W. G. Binn. in Glds. Inv. Mass., p. 216, f. 506.—SARS, Moll. Reg. Arct. Norv., p. 291, pl. 18, f. 3.

More globose than any of the preceding species. The figure is drawn from a Massachusetts specimen.

D. NIVEA Petterd. *Unfigured.*

Shell globose, very thin, semitransparent, milky-white, shining; whorls 4, spire small, scarcely projecting; longitudinally striated

with fine lines of growth ; aperture narrowly ovate, inflated. Alt. 14, diam. 7 mill. (*Petterd*).

Near River Leven, Tasmania (Miss Lodder).

Diaphanna nivea PET., Proc. Roy. Soc. Tasm., 1885, p. 321.

Section *Austrodiaphana* Pilsbry.

Shell like *Diaphana*, but columella abruptly truncated below.

D. BRAZIERI Angas. Pl. 26, fig. 68.

Shell subglobose, with a long, narrow open umbilicus, thin, hyaline, covered with a fine membranaceous olive epidermis; last whorl inflated; spire flatly depressed; whorls 3½, rounded above, suture impressed; aperture contracted above, subovate below; outer lip sharply angled posteriorly, slightly sinuous, arcuate below; columella abruptly truncate below the umbilicus. Length 2 lines, breadth 1½ lines. (*Ang.*).

Sow and Pigs reef, Port Jackson, N. S. Wales, Australia, 4 fms.

Diaphana brazieri ANG., P. Z. S., 1877, p. 175, pl. 26, f. 20 ; *t. c.* p. 189.

Genus CYLICHNA Lovén, 1847.

Bullina RISSO, Hist. Nat. Eur. Mérid., iv, p. 51, 1826. Not *Bullina* Fér., 1822.—*Cylindrella* SWAINS, Malacol., pp. 135, 326, type *C. alba* Sw. Not *Cylindrella* Swains, *t. c.* p. 311, (s. g. for *Conus asper* Chem.), nor of Pfr., Wiegm. Archiv f. Naturg., i, p. 38, (1840).—*Cylichna* LOVEN, Ofv. K. Vet. Akad. Förhandl., 1846, p. 142, 1847. Not *Cylichnus* Burmeister, Handb. der Entomologie, iv, p. 171, 1844 (Coleoptera).—*Bullinella* R. B. NEWTON, Syst. List Edwards Coll. Brit. Oligocene and Eocene Moll., p. 265, 1891.—*Cryptaxis* JEFFR., Ann. Mag. N. H., (5), xi, p. 400, 1883, type *C. parvula* Jeffr. Not *Cryptaxis* Lowe (Helicidæ).—" *Oliva*, Klein " H. & A. ADAMS, Gen. Rec. Moll., ii, p. 657.

+ *Cylichnella* GABB., and *Mnestia* H. & A. Adams.

Shell rather small and subcylindrical, the spire sunken and umbilicate or closed and concealed by the calloused inner lip ; moderately solid, smooth or with spiral striæ; aperture as long as the shell, narrow above, somewhat dilated toward the base; columella rather thickened, simple or somewhat sinuous; outer lip receding toward the suture. Type *C. cylindracea.*

Animal (pl. 61, fig. 23, *C. cylindracea*) with long head disc, truncated in front and behind. Mouth armed with a pair of jaws com-

posed of imbricating prickly elements; gizzard containing 3 equal, oval calcareous plates (pl. 61, figs. 26, 27, *C. alba*). Radula with the central teeth small, erect, with bilobed, serrate apices; laterals large, hooked, with a series of fine denticles near the edge; uncini small, simple, from 2 to 5 in number on each side (pl. 61, figs. 24, 25, *C. alba*).

In regard to the several names quoted in the above synonymy, *Bullina* of Risso is clearly preoccupied. *Cylindrella* Swainson was first acceptably defined on page 326 of the Treatise on Malacology, and is preceded by *Cylindrella* proposed for a section of *Conus* on p. 311 of the same work, and probably by *Cylindrella* Pfr. also, proposed for a well-known genus of land snails. The name *Cylichna* of Lovén has recently been rejected by Mr. R. B. Newton, on account of the prior *Cylichnus* of Burmeister in Coleoptera, and a new name, *Bullinella*, substituted; but if the generic name given by the great Scandinavian naturalist be ruled out, the genus must be given the name of one of the recognized subgenera.

In the present stage of our knowledge, it is practically impossible to definitely locate many species of small Bulloids, as the shells afford so slight a clue to the modifications of the soft parts. There are, therefore, numbers of forms which can equally well be placed in *Cylichna* as in the section *Cylichnina* of *Retusa*. Others might be placed in either *Cylichna* or *Haminea;* whilst the distinction between *Cylichna* and *Atys* is by no means clear in certain cases. At the same time, it must be clearly understood that the anatomical distinctions between *Cylichna, Cylichnina, Haminea*, etc., are very great. In these small smooth Bullidæ, as in the Zonitoid Helices, the differentiation has been mainly in the soft parts, the shells undergoing but little change.

Besides this confusion in the genera, there exists at present a semi-chaotic condition of the species; and so many Cylichnas are inadequately described, so many are still unfigured, that the identification of specimens is often an extremely difficult task. One could spend years of work over these groups of small species; but as the writer has neither the requisite time or facilities for redescribing the types and figuring them on a uniform and sufficiently enlarged scale, the present account may be considered as simply a digest of the literature of the group. As such, it is believed to be nearly complete.

Subdivisions of Cylichna.

Subgenus CYLICHNA Lovén.

Shell subcylindrical, the apex either concealed or umbilicated; surface unicolored whitish or brownish; columella with one indistinct fold or none. A further division of this subgenus will eventually be made, but in the present state of our knowledge of the group, the natural sections of *Cylichna* cannot be defined.

Subgenus MNESTIA H. & A. Adams.

Shell ovate-cylindrical, marbled or banded. Spire immersed in the deep umbilicus. Anatomy unknown.

Subgenus CYLICHNELLA Gabb.

Shell oblong-oval; spire concealed, imperforate; columella with a callous fold, and below it a nodule-like fold. Anatomy unknown.

Subgenus CYLICHNA Lovén.

Species of the North Atlantic, Arctic and Mediterranean Seas.

C. CYLINDRACEA Pennant. Pl. 29, figs. 15, 16, 17.

Shell cylindrical with parallel sides slightly tapering toward each end, squarely truncated above; solid and opaque. Surface slightly glossy, covered with a brownish-yellow cuticle; sculptured with numerous fine, superficial spiral striæ. Apex appearing like a slightly concave disc bounded by an angular keel, the whorls not visible. Aperture as long as the shell, narrow and parallel-sided above, suddenly expanding at the base. Lip strongly retracted above, forming a large, deep sinus; straight in the middle, and again retracted and effuse at base. Columella thickened, with a broad but indistinct fold. Alt. 7½, diam. 2⅝ mill.

European seas from Norway to the Canaries and Azores; Mediterranean; Whydah, W. Africa; St. Helena (Smith); *Ascension I.*, 420 fms. *and Tristan da Cunha* (Challenger).

Bulla cylindracea PENNANT, Brit. Zool. iv, p. 117, pl, 70, f. 85, 1777.—*Cylichna cylindracea* LOVEN, Ind. Moll. Scand. p. 142, 1846. —JEFFREYS, Brit. Conch. iv, p. 415; v, pl. 93, f. 4–5.—SARS, Moll.

Reg. Arct. Norv., p. 283, pl. 17, f. 12; pl. 11, f. 4.—Buq. Dautz. & Dollf., Moll. Rouss. i, p. 521, pl. 64, f. 1–3.—Watson, Challenger Gastrop., p. 663.—Mobius, in Die Zweite Deutsche Nordpolarfahrt, 1869–'70, (Koldwey), ii, p, 250, pl. 1, f. 4–9 (digestive tract and dentition).—Smith, P. Z. S. 1871, p. 738; P. Z. S. 1890, p. 297.—A. Ad. in Sowb., Thes. iii, p. 590, pl. 125, f. 132.—Forbes & Hanley, Hist. Brit. Moll. iii, p. 508.—*Bulla oliva* Gmel., Syst, Nat. (xiii), p. 3433.—*B. cylindrica* Brug., Encycl. Méth., p. 37 not of Gmelin.—*B. producta* Brown, Illustr. Conch., pl. 19, f. 15, 16.—*B. convoluta* Brocchi, Conch. foss. Subapp., p. 277, pl. 1, f. 7.—Scacchi, Catal. Conch. Req. Neap., p. 10, 1836.—*Cylindrella alba* Swainson, Malacol. p. 326, fig. 94b.

The cylindrical form and for the group large size of this species readily distinguish it from other European forms. The literature of the species is extensive, and only the more important references are given above. For others see Moll. Roussillon, Forbes and Hanley, and the Challenger Report.

Var. linearis Jeffr. Shorter, nearly smooth and decidedly glossy, marked at each end with yellowish-brown spiral lines, few and remote at the top, close-set at the bottom. Apex invariably perforated and showing part of the internal spire.

England; St. Helena.

C. cylindracea has been reported from *Bombay* by Melvill and Abercrombie.

C. alba Brown. Pl. 60, fig. 16.

Shell oblong, somewhat cylindrical, tapering toward both ends. White, covered with a pellucid buff cuticle; polished; surface sculptured by extremely close, fine, superficial spiral striæ, visible only under a strong lens, on fresh specimens. Aperture narrow above, dilated below, wider than in *C. cylindracea*; the lip curved as in that species. Columella thick but hardly folded. Apex imperforate, somewhat concave, bounded by a keel. Alt. 5½, diam. 2⅔ mill. Tooth-formula 5,1.1.1,5.

Spitzbergen and Greenland to the Bay of Biscay, and to Cape Cod.

Volvaria alba Brown, Illust. Conch. G. B., p. 3, pl. 19, f. 43, 44. —*Cylichna alba* Loven, Ofversight Vet. Akad. Förh. 1846, p. 142. Jeffr., Brit. Conch. iv, p. 417, pl. 8, f. 1a (dentition); v, p. 223, pl. 93, f. 6; Ann. Mag. N. H. (4), x, p. 241; (4), xix, p. 333; (4)

xx, p. 139, 237; P. Z. S. 1883, p. 393.—Sars, Moll. Arct. Norv., p. 283, pl. 17, f. 15, 16.—A. Ad., Thes. Conch. ii, p. 591, pl. 125, f. 137.—Gould, Inv. Mass. (edit. W. G. B.), p. 220, f. 98.—Leche, K. Svensk. Vet.-Akad. 1878, p. 72.—Watson, Chall. Rep. Gastr., p. 661.—Aurivillius, Vega Exped. iv, p. 369.—*Bulla triticea* Couth., Bost. Journ. N. H. ii, p. 88, pl. 2, f. 8.—*Cylichna elongata* Locard, Coq. Mar. Cotes France, p. 25, 1892.

Shorter and less cylindrical than *C. cylindracea*, and with far less obvious spiral striation than *C. occulta*.

Var. corticata (Beck) Möller. Pl. 60, figs. 14, 15.

Shell with a *thick, dark brownish epidermis;* somewhat narrower than the typical *alba*, cylindrical; vertex broadly truncated; columella indistinctly folded. Alt. 8 mill.

Norway; *Greenland.*

Bulla corticata (Beck) Moller, Ind. Moll. Groenl. Naturh. Tidskrift, p. 79, 1842.—*Cylichna alba var. corticata* Sars, Moll. Arct. Norv. p. 283, pl. 17, f. 16.—Aurivillius, Vega Exped. iv, p. 370. —*B.* (*Cylichna*) *corticata* Ad., Thes. ii, p. 592, pl. 125, f. 138.—*Bulla nucleola* Reeve, in The Last of the Arctic Voyages (Belcher's) ii, p. 393, pl. 32, f. 2, 1855.

C. chevreuxi Dautzenberg. Pl. 29, figs. 1, 2, 3.

Shell 6 mill. high, 2·7 mill. wide; solid, rather shining, cylindrical truncated above and below. Whorls 3, convoluted, the first immersed, the last smooth but with arcuate, obsolete growth-striæ. Aperture narrow, at base dilated. Columella very oblique, calloused, very shining. Lip acute, arcuate above, then straightened. Color white. (*Dautz.*).

Pico, Azores, 1287 meters.

C. chevreuxi Dautz., Rés. Camp. Sci. Albert I, p. 23, pl. 1, f. 6.

Differs from *C. alba* in the wider, thicker columella, and more effuse base of the aperture.

C. grimaldii Dautzenberg. Pl. 27, figs. 99, 100.

Shell 9 mill. high, 5 broad, rather solid, convoluted, subcylindrical, the base rounded. Apex obtusely truncated, imperforate, depressed in the middle. Last whorl with arcuate growth-lines and regularly ornamented with numerous impressed distinct spiral striæ.

Aperture narrow above, dilated below; columella short, arcuate; lip acute, projecting a little above the vertex, expanded toward the base. Color whitish, hyaline, under a brown epidermis. (*Dautz.*).

Dakar, W. Africa.

Cylichna grimaldii DAUTZ., Mém. Soc. Zool. France iv, p. 26, pl. 3, f. 1, 1891.

Compared with *C. alba*, this species is of larger size, less elongated form and thinner shell. The spiral striæ, which are effaced in the middle of *C. alba*, are more strongly marked, and cover the whole surface. It is larger than *C. propinqua* Sars, more cylindrical, less globose, with shorter, more arcuate columella, thinner shell and more distinct striæ.

C. OCCULTA Mighels. Pl. 28, figs. 35, 36, 37, 38, 39, 40, 41.

Shell solid, white, covered with a very thin whitish yellow epidermis; ovate, rather short and swollen, the diameter about two-thirds the altitude. Vertex obtusely truncated, slightly concave in the middle; base rounded; aperture not very narrow, dilated below, the outer lip projecting above the crown of the shell, a little arcuate and inflexed in the middle; columella nearly straight, with a broad fold. Surface smooth, polished, shining, but covered with many impressed, subundulating lines, which are quite conspicuous. Alt. 9 mill. Radula with the formula 2,1.1.1,2. (*Sars, C. propinqua*).

Norway, Spitzbergen and Greenland, south to Maine.

Bulla striata BROWN, Illustr. Conch. G. B., pl. 38, f. 41, 42; 1827. Second edit., p. 57, pl. 19, f. 41, 42.—*Cylichna striata* JEFFREYS, Ann. Mag. N. H. (4), xx, p. 492.—SMITH, *t. c.*, p. 140. Not *Bulla striata* Brug.—*Bulla occulta* MIGHELS, Proc. Bost. Soc. N. H. i, p. 50, 1841; Bost. Journ. N. H. iv, p. 54, pl. 4, f. 11.—GLD., Invert. Mass. (edit. W. G. B.), p. 223.—KRAUSE, Zool. Jahrbücher, vi, p. 363.—*Bulla reinhardi* Holb., MOLLER, Index, Moll. Groenl. p. 6, 1842.—*Cylichna reinhardi* LECHE, K. Sv. Vet.-Akak. Handl. 1878, p. 72, pl. 1, f. 21.—AURIVILLIUS, Vega-Exped. iv, p. 370.—*Bulla scalpta* REEVE, in The Last of the Arctic Voyages (Belcher's), ii, p. 392, pl. 32, f. 3 (bad).—*cf. Cylichna scalpta* LECHE, *t. c.*, p. 73, pl. 1, f. 22.—*Bulla propinqua* M. Sars, 1858, G. O. SARS, Moll. Reg. Arct. Norv., p. 284, pl. 18, f. 5.

This species is distinguished by its rather inflated form and obvious spiral striation. Jeffreys and others have called it *C. striata*

Brown, but Brown's *Bulla striata* is preoccupied by *Bulla striata* Bruguiere.

It may be that *C. occulta* is distinct from *scalpta*, as Leche claims, and Krause agrees; but my material is not sufficient to show the distinction.

C. RICHARDI Dautzenberg. Pl. 29, figs. 4, 5, 6, 7.

Shell 1⅝ mill. high, 3 mill. wide; rather solid, convoluted, ovate-cylindrical, the apex mamillated. Last whorl sculptured with spaced series of little, round impressed pits. Aperture narrow above, dilated and rounded below, as long as the shell. Columella straight, thickened; lip acute, subarcuate; color dull white. (*Dautz.*).

Pico, Azores, 1287 meters.

Cylichna richardi DAUTZ., Rés. Camp. Sci. Albert I, i, p. 23, pl. 1, f. 7.

C. PARVULA Jeffreys. Pl. 59, figs. 4, 5.

Shell forming a short cylinder, rather solid for its minute size, semitransparent, and glossy: sculpture, numerous and very fine wavy lines of growth; the crown or apex is encircled by a thickened riblet or ridge; half-grown, and especially young specimens exhibit a sunken spire of one or two whorls with a globular nucleus; colour clear white; mouth contracted above and in the middle, wide and rounded below; outer lip curved at each end, slightly projecting beyond the crown; apex perforated; pillar short, flexuous, notched at the base. Length 0·06, breadth 0·03 inch. (*Jeffr.*).

Off Crete, 70–120 fms. (Spratt).

Cylichna parvula JEFFR., Ann. Mag. N. H. (5), xi, 1883, p. 400, pl. 16, f. 9.—*Cryptaxis parvula* MONTS., Nom. Gen. e Spec., p. 144.

This is perhaps the type of a distinct genus between *Cylichna* and *Utriculus*, which may be called *Cryptaxis*, because the spire is partly concealed. A little Madeiran shell, discovered by the Rev. Robert Boog Watson, and named by him *Utriculus tornatus* or *U. spretus*, somewhat resembles the present species, but is much larger and oval; and the spire is more visible, although sunken and partly concealed. (*Jeffr.*).

C. CREBRIPUNCTATA Jeffreys. Pl. 27, figs. 2, 3, 4.

Shell oval, thin, semitransparent and glossy; sculpture, very numerous and regular fine spiral or revolving striæ, which are

closely punctured; they are stronger at the base than at the crown; colour white; spire deeply sunken, and for the most part concealed in a small cavity in the center of the crown; but the bulb-shaped apex is visible at the bottom of the cavity; mouth semi-oblong, contracted above and expanding below; outer lip slightly raised above the crown and channelled, curved in the middle and at the base; inner lip inconspicuous; pillar straight on the upper half and incurved below. Length 0·2, breadth 0·1 inch. (*Jeffr.*).

West of "Wyville-Thomson ridge," N. lat. 59° 51′ 2″ *W. lon.* 8° 18′, 570 fms.

Cryptaxis crebripunctatus JEFFREYS, P. Z. S. 1883, p. 398, pl. 44, f. 11.

In the 'Annals and Magazine of Natural History' for June, 1883 I indicated the probability that a species which was there described and figured as a *Cylichina parvula* might be the type of a distinct genus, intermediate between *Cylichna* and *Utriculus*, because the spire was partly concealed; and I suggested the name *Cryptaxis*. I am now encouraged by the discovery of the present species to adopt the above generic name. (*Jeffr.*).

BULLINA ELONGATA Jeffreys, Ann. Mag. N. H. (5), vi, p. 318 and Rep. Brit. Asso. Adv. Sci. 1880, p. 387. *Bay of Biscay.* Name only.

Species of the east coast U. S., West Indies, etc.

C. DOMITUS Dall. Pl. 48, fig. 12.

Shell solid, yellowish-white, short, broad and squarely truncate in front with a rather blunt mammiform spire exhibiting about three turns; surface transversely marked with faint lines of growth, and near the suture with fine well-marked wrinkles, as if too large for the spire around which the posterior fourth of the whorl is closely wound and very strongly appressed, giving the posterior edge of the last whorl especially a bevelled appearance; spiral sculpture, extremely fine grooves, not puncticulate, strong on the posterior aspect, obsolete on the body (which appears polished), and, except in the young, on the anterior extreme; the sutural wrinkles are prettily shagreened by the intersection of these fine close grooves; spire very obliquely wound, the margin of the volutions rounded (notwithstanding its being closely appressed) and the rounded edge

often eroded showing the inner porcellanous under the outer more cretaceous layer, the extreme apex eroded in all the specimens obtained; aperture very wide in front, extremely narrow behind; the margin retreating from the columella to half way between axis and exterior, almost straight in front, then rising and continuing backward nearly parallel to the axis, and falling away again obliquely to the suture, forming an extremely narrow and deep notch; body with a thin deposit of white callus, columella hardly thickened, spiral, passing without noticeable interruption into the anterior margin; outer lip sharp, thin.

Lon. of shell 9·0; of aperture 7·5; max. lat. of shell 5·25; of aperture 3·37 mm.

Off Bequia, 1591 fms.; *off Guadelupe*, 732 4 fms.

Utriculus (*vortex var. ?*) *domitus* DALL, Blake Gastr., p. 47, pl. 17, f. 8.

This shell has a distant resemblance to an *Actaeon* which it is not, as is evident on inspection. It may prove a *Cylichna* when the soft parts are known, reference until then being necessarily provisional. It is peculiarly bevelled off behind and abrupt in front, and is stouter than most shells of this group. It is possible that in the young at some stage the nucleus may be entirely enrolled. It quite distinct from anything recent or fossil which I find figured. It is most nearly allied to *U. ? vortex* Dall, which is a smaller, proportionally more slender, cylindrical shell, with somewhat different sculpture and a blunter spire. In the figure of *U. ? domitus* the wrinkles on the spire are not sufficiently emphasized as compared with the lines of growth, nor is the difference in sculpture between the body and the posterior aspect as sharply defined as it appears under a good lens. This species differs from *Utriculus spatha* Watson in form and in the absence of folds on the columella. It differs from *U. oliviformis* Watson in the proportion of the spire to the whole length, in the unequal distribution and different character of the sculpture. But I doubt if these species do not vary greatly, and the discovery of intermediate links between them and *U. vortex* would not surprise me in the least. (*Dall*).

C. VORTEX Dall. Pl. 21, fig. 7.

Shell stout, rather solid, opaque white, short, the posterior fourth bevelled off toward the bluntly rounded summit; transverse sculpture consisting of occasional faint lines of growth, nowhere very

prominent; spiral sculpture consisting of very numerous fine grooves, so crowded near the ends of the shell as to be but little narrower than the interspaces; these grooves are only visible under a lens, are occasionally reticulated by the lines of growth and gradually become more distant toward the middle of the shell; just in advance of the shoulder of the bevel are a small number of equally fine raised lines, which are so minute that only by the most careful inspection and under strong magnification can they be distinguished from the grooves which cover the rest of the shell; the folds of the outer whorl are appressed toward the apex, with a somewhat thickened and irregular margin, which leaves a minute pit at the summit and about two volutions visible; this appressed margin is often eroded, and then some four or five turns can be made out; in advance of the bevel the shell is nearly cylindrical, rather suddenly rounded in front; outer lip straight, slightly produced in the middle, but not bent inward toward the body; passing imperceptibly into the column, over which, as well as over the body, is a thin layer of callus. Aperture rounded and rather wide in front, narrowing to an acute point behind, shorter than the shell; pillar with no twist or fold, continuous with the margin. Lon. of shell, 7·5; of aperture, 6·0. Max. lat. of shell, 4·25; of aperture, 2·5 mill. (*Dall*).

East of George's Bank to off Chesapeake Bay, 326–1356 fms.

Utriculus ? vortex DALL, Bull. M. C. Z. ix, p. 100, 1881; Blake Gastr., p. 47, pl. 17, f. 3, 1889.—*Cylichna vortex* BUSH, Bull. M. C. Z. xxiii, p. 221.

After comparing this with the figures of all the Northern species given by Sars and those from the West Indies by d'Orbigny, it seems quite distinct from any of them. It is possible that it may prove to be a *Cylichna* when the animal is known; but it does not agree with any of the figured *Cylichna*. (*Dall*).

In studying the specimens labelled *Cylichna dalli* in the Fish Commission collection I found some confusion in the identification, and that two similar but distinct forms had been placed under that name: *Cylichna dalli* Verrill, and *Cylichna vortex* Dall. The differences in the two species are clearly shown in the figures quoted above. *C. dalli* is most readily distinguished by its "strongly excavated and sinuous" columella, which forms anteriorly a distinct fold or tooth-like projection where it joins the strongly curved outer lip; while *C. vortex* has a gently curved columella, passing "imperceptibly" into the outer lip without "twist or fold."

In this species the apical whorl is smooth, upturned, and sunken in a shallow pit formed by the two succeeding whorls, one rising a little above the other, with a slightly rounded sutural margin. In some specimens these are so closely coiled as nearly to conceal the nucleus, while in others each turn is visible. The following turns are more loosely coiled, and the outer lip joins the body whorl a little below the apex of the shell. Some of the Fish Commission specimens are considerably larger than Mr. Dall's types, and more slender in proportion to their length. One perfect specimen is 16½ mill. long and 8 broad; another worn and broken one is about 29 mill. long and 13 broad; while still another is 23 mill. long and 11 broad. (*Bush.*).

A careful study of the radula and gizzard shows that the correct position of the species is with the Cylichnæ. The radula consists of a series of strongly hooked, dark amber teeth, the lateral ones with broad curved bases and the marginal ones with simple straight bases, arranged in rows of five or seven on each side of the minute median tooth, in small specimens these hooks are distinctly roughened on the under surface by fine, raised longitudinal lines. The three plates of the gizzard are club shaped, with a yellow-white flattened exterior surface and a dark reddish-brown convex interior surface, the greatest convexity situated beyond the middle, in the broader end, with a little flattened space in front defined by a lighter shade of color. (*Bush*).

C. DALLI Verrill. Pl. 48, fig. 13.

Shell elongated, white, translucent, somewhat barrel-shaped, a little broader medially, but nearer the anterior end; considerably narrowed posteriorly, with a small pit at the apex. No umbilicus. Aperture as long as the shell, very much narrowed posteriorly, and ending in a narrow slit in the sutural line; anteriorly it increases gradually about to the anterior third, when it suddenly expands into an ovate anterior portion, by the strong excurvature of the columella margin, and a slight expansion of the outer lip. The outer lip rises, posteriorly, slightly above the level of the body-whorl, in the form of a thin edge, separated from the body-whorl by a narrow, deep fissure; passing backward it forms a gently sloping shoulder, and is very slightly convex and divergent to the anterior end, where it is cut away for the entire width of the shell, and joins the columella lip in a regular curve, with a sharp edge, not reflexed; the columella-margin is strongly excavated and sinuous and in the

larger specimens has a slight fold, anteriorly; a thin, white callus covers the inner lip. The body-whorl is broadly convex, rounded off gently anteriorly, and more abruptly posteriorly. The pit at the apex, is well defined, showing some of the volutions, but is injured in both of my specimens. Whole surface covered with fine, close, minutely wavy spiral lines, scarcely visible without a lens. Animal unknown. Length of the largest, 10 mill.; breadth in the middle, 5·25 mill. (*Verrill*).

F. C. Stations 997 *and* 999, in 335 and 266 fathoms. 1881.

Cylichna ? dalli VERRILL, Trans. Conn. Acad. v, p. 542, 1882; vi, p. 274, pl. 29, f. 15, 1884.—*Conf.* DALL, Blake Gastr. p. 47, and BUSH, Bull. M. C. Z. xxiii, p. 221.

See notes under *C. vortex* for the distinguishing features of this species.

C. VERRILLII Dall. *Unfigured.*

Shell similar to *C. alba* Brown, in size and form with the exceptions following: It is bluish-white and never has the brown outer coat of *C. alba*, though the extremely thin epidermis sometimes shows a light brown line marginating the apex. It is covered all over with fine spiral striæ. The columella is thickened and twisted more than occurs in *C. alba*, and in *C. verrillii* has the effect of an incipient plait. Lastly the aperture extends farther behind the spire than in *C. alba*, and, instead of the margin being curved over to a slight callus sealing the apex, there is a well marked perforation, most marked in the adult shells. Largest specimen 7·5 long by 3·0 mill. wide.

Habitat, off the coast of North Carolina, at stations 2592, 2595, 2596, 2602 and 2612 of the U. S. Fish Commission, in from 50 to 124 fms., sand, bottom temperature 58–75° F.

Cylichna verrillii DALL, Blake Gastr., p. 54.

This species is larger and more cylindrical than *C. umbilicata* of Europe. It is nearer *C. cylindracea* var. *lineata*, but is shorter in proportion to its width, and its body is also shorter in proportion to the whole length and more obliquely attenuated to the columella. It has a striking similarity to *C. alba* when decorticated, until closely examined. (*Dall*).

C. EBURNEA Verrill. Pl. 27, fig. 5.

Shell moderately large for the genus, firm, solid and thick for a shell of this group. The shell is somewhat elongated, broadest in

the middle, tapering toward the posterior end and broadly rounded in front, so that the outline is somewhat conical, but truncated posteriorly. At the tip there is a small, but rather deep pit. The outer lip is thickened, and somewhat constricted below the middle and then slightly expanded and broadly rounded anteriorly; posteriorly it bends inward and projects slightly beyond the tip of the shell, and forms a distinct, rounded, posterior sinus. The columella margin is thickened, without a fold, and moderately excurved. The umbilicus is narrow but deep. The aperture, in front of the middle, is moderately broad and ovate, but farther back it is much narrowed and encroached upon by the body-whorl. The surface is smooth and polished, without any sculpture except a few faint spiral lines close to the posterior end and others which are wavy and even less distinct at the anterior end. Color of the type-specimen, pure white, with a very thin yellowish-white epidermis on some parts. Length 6 mill.; greatest breadth, 4 mill.; length of aperture equal to that of the shell; its greatest breadth, 1·8 mill. (*V.*).

Station 2265, *off Cape Hatteras,* in 70 fathoms.

Cylichna eburnea V., Tr. Conn. Acad. vi, p. 428, pl. 44, f. 14.

This species is readily distinguished from all others of our coast by its thickness and solidity, by its distinct umbilicus and by the evident pit at the posterior end. In form it somewhat resembles *Diaphana conulus* but it is less narrowed posteriorly, besides being a much larger and stouter shell. (*V.*)

C. DISCUS Watson. Pl. 30, fig. 7.

Shell narrowly cylindrical, truncated in front like *Cylichna alba* (Brown), smooth, thin, polished, with a small disk-like minutely perforated top. Sculpture: Longitudinals—there are very faint and slight lines of growth. Spirals—there are some very doubtful indications of a coarse spiral structure in the texture of the shell. Colour milky-white and glossy. Mouth the full length of the shell but not more, extremely narrow with lips nearly parallel till they diverge in front, the inner lip following the slow basal contraction, while the outer expands a very little, as is the case in *Cylichna umbilicata* (Mont.); at the upper end is a small narrow, but deepish rounded sinus. Outer lip; its edge is very straight, retreating a little quickly above and slightly in front; its direction is straight, with the very slight bend to the right spoken of above. Top a little contracted, rounded, with a sort of thickened pellucid disk which is

almost perfectly horizontal, so that the whole top of the body-whorl and the upper corner of the mouth are on the same level; in the center is a minute closed pore. Inner lip; there is a thin narrow glaze which thickens and expands in front: it is not expanded on the top. Pillar is short, slightly oblique and twisted, with a strongish defined tooth, in front of which it is rather abruptly truncate. Alt. 0·156 in.; diam. 0·066. Mouth, breadth at same place, 0·014 inch. (*Wats.*).

North of Culebra Island, West Indies, 390 fms.

Cylichna discus WATS., Challenger Gastr., p. 664, pl. 49, f. 10.

Cylichna protracta (Gould) is very like this in front, but rises much higher above. *Cylichna cylindracea* (Pennant), is slightly slimmer or narrower in proportion to length, has the body-whorl a little smaller, and the mouth slightly broader, lacks the slight posterior narrowing, and is squarely truncate behind, while here the shell is rounded. The Challenger species, too, quite wants the very peculiar form of the upper corner of the mouth which is characteristic of *Cylichna cylindracea*. *Cylichna alba* (Brown), of the same size, is rounder and less cylindrical, being more attenuated above especially; the mouth is extended above the top of the shell; the top of the body-whorl is more oblique and less truncated. (*Wats.*).

C. AUBERI Orbigny. Pl. 41, figs. 21, 22.

Shell ovate-cylindrical, obliquely truncated at the ends, thin, pellucid, white, smooth, delicately spirally striated below; spire immersed, replaced by an imperforate depression; aperture narrow, straight, dilated below. Alt. 3, diam. 2 mill. (*Orb.*).

Cuba.

Bulla auberii ORB., Moll. Cuba i, p. 127, pl. 4 *bis*, f. 5–8.—*Cylichna auberi* DALL, Blake Rep., p. 55; Cat. Mar. Moll. S.-E U. S., p. 84.

C. KREBSII Mörch. *Unfigured.*

Shell short, cylindrical, regularly spirally striated, the growth-striæ well developed. Lip a little produced above. Spire imperforate, covered by a thin callus; columella strongly angulate, as in *Haminea succinea* Couth. Alt. 8, diam. 4 mill. (*Mörch*).

St. Barts; St. Martins; Anguilla (Krebs).

Cylichna krebsii Mch., Malak. Bl. xxii, p. 172.—*Conf.* Dall, Blake Gastr., p. 55.

Smaller than *Bulla* (*Haminea*) *curta* A. Ad., and aperture very narrow, according to Mörch; but in my opinion it is identical with that species.

C. noronyensis Watson. Pl. 30, figs. 1, 2.

Shell small, oval, broadest below the middle, narrowing to both ends, but especially upwards, thin transparent, and glossy, rather strongly and remotely striate spirally above and below, the narrow mouth is longer than the body, the top is conically depressed, the straight, slightly oblique, scarcely toothed pillar has behind it a minute furrow and chink. Sculpture: Longitudinals—there are fine hair-like lines of growth. Spirals—the middle of the shell is smooth; in front there are about eight strongish remote crimped furrows; these become rather crowded on the base; above there are about four similar furrows. Colour hyaline white. Mouth long, narrow, curved throughout its whole length. Outer lip rises very slightly above the body, is rounded, with a very slight angulation at the outer corner, from which point to the corner of the base it is a little flatly curved; on the base the curve is rapid, and the shell is there slightly emarginate. Top is small, oblique, and has a conical depression in the middle behind the lip. Inner lip flatly curved on the body; the pillar is almost quite straight but a little oblique in its direction. There is a very faint appearance of a tooth on it in front, and behind it is a small furrow and chink. Alt. 0·07 in. diam. 0·04. Mouth, breadth at same place, 0·01 inch. (*Wats.*).

Off Fernando de Noronha, 7–25 fms.

C. noronyensis Wats., Chall. Gastr., p. 666, pl. 50, f. 1.

This may very possibly be a young shell, but among the Bullidæ it is impossible to judge whether a solitary specimen is full grown or not. Compared with the young of *Bulla semilaevis* Seg., this is much slimmer in form, with a longer and smaller body, it is more narrowed and pointed at both ends, and is much more strongly and definitely striate. Compared with the young of *Bulla hydatis* Linne, besides these same points of distinction, there is the strong curve of the line of the mouth, which in that species is nearly straight. *Atys speciosa* A. Adams, is in form very like but is shorter and broader, and more contracted posteriorly; and this Challenger species is not

an *Atys*. Something without colour between *Cylichna marmorata* A. Adams, and *Cylichna bizona* A. Adams, would be very near. *Cylichna luticola*, C. B. Adams, is much more cylindrical.

Species of the West coast of the Americas.

C. LUTICOLA C. B. Adams. *Unfigured.*

Shell subcylindric, wider anteriorly; pale horn color, subtransparent; with the striæ of growth very minute; apex in a deep narrow umbilicus, which is partly covered by the upper part of the labrum; last whorl compressed around the middle; aperture rising higher than the umbilicus, linear above, suborbicular below; labrum very thin, much advanced along the middle; columella thickened with a callus; anterior umbilical region indented, partly covered with a deposit. Length ·2 inch.; breadth ·095 inch. (*Ad.*).

Panama (Adams); *Mazatlan* (Cpr.).

Bulla (*Cylichna*) *luticola* C. B. AD., Pan. Cat., p. 215, 319.—*Haminea luticola* ADS., Gen. Rec. Moll. ii, p. 16.—*Cylichna luticola* CPR., Maz. Cat., p. 170; Moll. Western N. A., p. 34, 194; Brit. Asso. Rep. for 1856, p. 250, 275, 313.

Carpenter suggests that the following species may be the young of this.

Station: This species was found crawling on liquid mud, near low water mark, at the bottom of a steep sand beach.

C. CARPENTERI Hanley. *Unfigured.*

Shell minute, cylindrical, short, subretuse in the middle, white, slightly attenuated above and below, sculptured all over with slender close longitudinal, and closer very fine spiral liræ; apical umbilicus large, showing the whorls of the spire; outer lip rounded throughout, projecting above the apex behind, retuse in the middle; columella straight, long, narrow. Alt. one-thirteenth of an inch. (*Hanley*).

Mazatlan (Mus. Hanley).

Bulla (*Cylichna*) *carpenteri* HANLEY, P. Z. S. 1858, p. 543.—*Conf.* CPR., Moll. W. N. A., p. 34.

C. PLANATA Carpenter. *Unfigured.*

Shell small, cylindrical, subelongate, white, smooth, covered with a straw-colored epidermis; margins nearly parallel; spire flat, hardly

umbilicated, slightly mamillate. Whorls 4, convoluted, sutures little impressed; base moderately effuse; lip thin, rather produced in the middle, broadly arcuate in front, a little sinuous behind, scarcely channelled; toward the suture quite rounded. Inner lip distinct, somewhat calloused behind; columella with quite a marked fold, the axis revolving around the base. Alt. ·11, diam. ·055 inch. angle of divergence 180°. (*Cpr.*).

San Diego, California.

Cylichna planata Cpr., Journ. de Conch. 1865, p. 139; Moll. Western N. A., p. 133, 307.

C. PROPINQUA Smith. *Unfigured.*

Shell elongated, cylindrical, a little contracted in the middle, white, covered with a pale brown epidermis, browner above and below; transversely very finely undulately striated. Vertex excavated, narrowly perforated in the middle, surrounded by an acute margin. Aperture narrow above, dilated below, lip nearly parallel with the whorl; columella spirally twisted.

Alt. 13, diam. 5 mill. (*Sm.*).

Vancouvers Island.

C. propinqua Sm., Ann. Mag. N. H. (4), ix, p. 351, 1872.

This species in general aspect reminds one of the common *C. arachis* Q & G.; but it is considerably narrower, with the vertex only excavated with a minute perforation, not umbilicated, and the basal margin of the aperture is roundly truncate. (*Sm.*).

C. ATTONSA Cpr.

Cylichna (cylindracea var. ?) attonsa Cpr., Moll. W. N. A. pp. 23, 89, 133, 169.

An undescribed form from the Vancouver district.

Species of Japan and China.

C. SEMISULCATA Dunker. Pl. 26, figs. 78, 79, 80.

Shell cylindrical, rather solid, rounded at both ends, white, covered with a pale brown epidermis; delicately and densely longitudinally rugate, transversely sulcate at the base; lip acute, somewhat straightened; aperture as usual, dilated in front; columella rimate. Alt. 18, diam. 8 mill. (*Dkr.*).

Japan; exact locality unknown.

C. semisulcata Dkr., Index Moll. Mar. Jap., p. 163, pl. 13, f. 7–9.

C. japonica A. Ad. is certainly similar, but seems to differ in being transversely sulcate throughout, and lacks the close longitudinal wrinkles.

C. japonica A. Adams. *Unfigured.*

Shell cylindrical, rimate-umbilicate, usually covered with a thin brown epidermis, rounded at both ends; apex perforated, transversely very delicately striated throughout, the striæ more distant in front. Aperture linear, dilated in front; inner lip thin, elongated, simple; outer lip rather straightened, strongly produced and roundly angled behind. (*Ad.*, Ann. Mag. Nat. Hist. (3), ix, p. 150, Feb., 1862).

Korea Strait, 46 fms.

Next to *C. arachis* Quoy, which was likewise obtained in the Korea Strait, this is the largest species of *Cylichna*, it differs from that species in being more elongated and less robust; and in the angle of the outer lip being produced and angulated, extending considerably beyond the apex. (*Ad.*).

C. proxima A. Adams. *Unfigured.*

Shell ovate cylindrical, rounded at the ends, white, solid, shining, subopaque, transversely very minutely striated throughout; apex profoundly umbilicate; aperture linear, constricted in the middle, dilated anteriorly, inner lip furnished with a thick oblique fold; outer lip straight in the middle, arcuate in front, posteriorly subproduced and rounded. (*Ad.*, *l. c.*, p. 151, no. 2).

Tsu-Sima, Japan, 26 fathoms.

Resembles *C. sarsii* Phil.; but the aperture is constricted in the middle; it is also like *C. concinna* A. Adams, but is stouter and not produced anteriorly, and the angle of the outer lip is rounded. (*Ad.*).

C. venustula A. Adams. *Unfigured.*

Shell ovate-cylindrical, somewhat narrowed at each end, white, rather solid, shining, transversely very finely striated throughout, the apex perforated. Aperture linear, dilated in front; inner lip arcuate, with an oblique fold, slightly truncated below; outer lip with regularly arcuate margin. (*Ad.*, *l. c.*, p. 151, no. 3).

Mino-Sima, Japan, 63 fathoms.

Has the form of *C. alba* Brown, and the sculpture of *C. concinna*, but differs from the latter in being more robust, and in the inner lip being furnished with a distinct oblique plait. (*Ad.*).

C. RIMATA A. Adams. *Unfigured.*

Shell ovate-cylindrical, rimate-umbilicate, white, thin, shining; striated at each end; apex perforated; aperture linear, acuminate in front, produced; umbilical chink wide; inner lip thin, arcuate, simple; outer lip rounded and produced behind the margin, a little straightened. (*Ad., l. c.*, p. 151, no. 4).

Korea Strait, 46 fathoms.

Most like *C. umbilicata* Mont; but the last whorl is not acuminate posteriorly, the aperture is produced in front, and the inner lip is long and arcuated. (*Ad.*).

C. LATIUSCULA A. Adams. *Unfigured.*

Shell small, ovate-cylindrical, acuminate in front, wider behind, rimate-umbilicate, white, thin, smooth, shining; apex profoundly perforated; aperture narrow; inner lip thin, simple, arcuate; outer lip produced behind, broadly rounded. (*Ad., l. c.*, p. 151, no. 5).

Tabu-Sima, Japan, 25 fathoms.

Most like *C. rimata* A. Adams, but is shorter and much wider posteriorly, and the angle of the outer lip is more rounded; it wants, moreover, the transverse striæ at each end. (*Ad.*).

C. LEPIDULA A. Adams. *Unfigured.*

Shell cylindrical, snowy, solid, polished, in the middle slightly narrowed, posteriorly truncated, the apex slightly perforated, surrounded by an acute margin. Aperture linear; inner lip calloused, with a strong fold; outer lip with inflexed margin. (*Ad., l. c.*, p. 152, no. 6).

Tsu-Sima, Japan, 26 fathoms.

This species differs from all others described, in the periomphalus, or hind part of the body-whorl enclosing the sunken apex, forming an acute well defined ridge. It is a small, white, highly polished, opaque shell. (*Ad.*).

C. CONSOBRINA A. Adams. *Unfigured.*

Shell cylindrical-ovate, slightly rimate, white, rather solid, longitudinally striated, and striated at both ends, the striæ distant;

aperture narrow, inner lip strongly plicate in front; outer lip subarcuate. (*Ad., l. c.*, p. 152, no. 7).

Mino-Sima, Japan, 63 fathoms.

Most like *C. rimata*, but is more solid, longitudinally striated, and wants the conspicuous umbilical fissure of that species. (*Ad.*).

The name is preoccupied by Gould for another Japanese species, but it is hardly worth while proposing another for this species until it can be properly redescribed and figured.

C. PARALLELA A. Adams. *Unfigured.*

Shell cylindrical, rimate, whitish, rather solid, striated at both ends; longitudinally strigose, last whorl parallel-sided. Aperture linear produced anteriorly; inner lip with a reflexed callus closing the chink, outer lip straightened, posteriorly produced and angulated. (*Ad., l. c.*, p. 152, no. 8).

Tsu-Sima, Japan, 16 fathoms.

Most nearly resembles *C. involuta* A. Adams; but the aperture is produced and pointed anteriorly, the sides of the body-whorl are nearly parallel, and the outer lip forms posteriorly a produced angle. (*Ad.*).

C. ASSIMILIS A. Adams. *Unfigured.*

Shell cylindrical, dull white, solid, rather short, truncated behind, dilated; acuminate in front; under a lens seen to be obsoletely transversely striated throughout; aperture linear, inner lip thickened, the fold vanishing; outer lip with somewhat straightened margin, posteriorly subproduced and rounded. (*Ad., l. c.*, p. 152, No. 9).

Mino-Sima, Japan, 63 fms.

A small species, somewhat resembling *C. involuta* A. Adams, but much shorter, dilated behind, narrowed in front, and with the hind angle of the outer lip rounded. (*Ad.*).

C. PUMILA A. Adams. *Unfigured.*

Shell small, white, thin, ovate-cylindrical, subconstricted in the middle, rounded at both ends, longitudinally substriate; aperture a little widened, the inner lip thin, arcuate, simple; outer lip with the margin inflexed in the middle. (*Ad., l. c.*, p. 153, No. 10).

Tsu-Sima, Japan, 16 fms.

A small, thin, elongate-oval species, somewhat contracted in the middle. It is very unlike any other hitherto described. (*Ad.*).

C. CANDIDULA A. Adams. *Unfigured.*

Shell cylindrical, white, closely transversely striated throughout, posteriorly subtruncate, anteriorly produced and somewhat acuminate; aperture linear, the inner lip somewhat thickened, obsoletely uniplicate in front; outer lip a little straightened in the middle, slightly produced behind and rounded. (*Ad., l. c.*, p. 153, No. 11).

Tsu-Sima, Japan, 26 fms.

This species partakes of the character of *C. venustula* and *concinna* with regard to sculpture and general appearance, but is elongated and cylindrical. (*Ad.*).

C. INEDITA A. Adams. *Unfigured.*

Shell cylindrical, subtruncate posteriorly, acuminate in front, white, thin, longitudinally strigose; aperture linear, anteriorly produced; inner lip elongate, flexuous, with a conspicuous parietal fold, outer lip with straight margin, posteriorly subproduced and rounded. (*Ad., l. c.*, p. 153, No. 12).

Mino-Sima, Japan, 63 fms.

A small, thin, strigose species, with the aperture anteriorly produced, and with an elongate subspiral fold at the fore part of the inner lip. (*Ad.*).

C. PERTENUIS E. A. Smith. *Unfigured.*

Shell small, slightly umbilicate, very thin, dull whitish, pyriform-cylindrical, minutely perforated at the vertex, little shining, longitudinally very delicately and very closely arcuate striate; aperture very narrow above, slightly produced above the vertex, dilated at the base; columella rather straightened, rather thickened, slightly reflexed toward the umbilicus. Alt. 3½, diam. nearly 2 mill. (*Sm.*).

N. lat. 42° 52′, *E. lon.* 144°, 40′, *off Japan*, in 48 fms.

Cylichna pertenuis SMITH, Ann. Mag. N. H., (4), xvi, p. 113.

The longitudinal striation is very minute, and only visible under a powerful lens. The form is scarcely sufficiently pyriform to warrant me in placing this species in the subgenus *Sao*. (*Sm.*).

C. VILLICA Gould. *Unfigured.*

Shell minute, ovate-cylindrical, subconic at both ends, banded with white and ferrugineous, sculptured with revolving lines and

closely plicate above, vertex widely perforated; aperture narrow; lip scarcely rising above the apex; columella subperforate, with an obsolete fold. Alt. 3, diam. 1·5 mill. (*Gld.*).

China Seas.

C. villica GLD., Proc. Bost. Soc. N. H., vii, p. 139; Otia, p. 112.

C. ELLIPSOIDEA Gould. *Unfigured.*

Shell minute, solid, elongated-elliptical, ivory-white, transversely striated; apex involute, widely umbilicate; lip scarcely rising above the apex, broadly arcuate. Aperture very narrow, acute anteriorly; columella short, strong, with a moderate fold; parietal wall covered with a copious callus. Alt. 3, diam. 1 + mill. (*Gld.*).

Loo Choo Is.

C. ellipsoidea GLD., Proc. Bost. Soc., N. H., vii, p. 140; Otia, p. 112.

C. LÆTA Gould. *Unfigured.*

Shell small, ovate, elongated, milky, shining, transversely striated (viewed under a lens); vertex perforated; aperture enlarged below; lip produced behind; columella profoundly incurved, imperforate, with a moderately conspicuous fold. Alt. 5, diam. 2 mill. A somewhat tumid, very symmetrical species. (*Gld.*).

Kago-Sima.

C. læta GLD., Proc. Bost. Soc., vii, p. 140; Otia, p. 112.

C. CONSOBRINA Gould. *Unfigured.*

Shell cylindrical, short, narrowed in front, truncated behind, rather solid, whitish, covered with a very fugacious epidermis, transversely striatulate. Vertex indented, angular; aperture narrow, straight, the lip flattened at apex; columella short, twisted. Alt. 6, diam. more than 2 mill. (*Gld.*).

West Coast of Jesso.

C. consobrina GLD., Proc. Bost. Soc., vii, p. 141; Otia, p. 113.

Size and general form of *C. triticea*, but less rounded at the extremities, and pillar-fold less obvious. *C. corticata* is nearly the same (*Gld.*). This may be a north Pacific form of *C. alba var. corticata.*

C. OPOROSA Gould. *Unfigured.*

Shell minute, slender, cylindrical, greenish, polished, or very minutely spirally striated at the base; vertex obtuse, very openly

umbilicated. Aperture narrow, linear; columella fold conspicuous, hardly perforated. Alt. 4, diam. 1 mill. (*Gld.*).

Hong Kong Harbor.

C. oporosa GLD., Proc. Bost. Soc. N. H., vii, p. 140; Otia, p. 112.

C. PROTRACTA Gould. *Unfigured.*

Shell rather large, solid, cylindrical, bony, spirally sculptured; apex obliquely truncated, carinated, with a crater-shaped perforation. Aperture narrow; lip angular behind; columella short, solid, strongly plicate. Alt. 12, diam. 5 mill. (*Gld.*).

Coast of China.

C. protracta GLD., Proc. Bost. Soc., vii, p. 140; Otia, p. 113.—SMITH, Zool. Coll. Alert, p. 505.

Smith reports this species from Cerf Island, Mascarenes, 10 fms.

C. MELAMPOIDES Gould. *Unfigured.*

Shell small, solid, ovate, ivory-like, polished, encircled by striæ anteriorly; vertex obtuse, impressed, imperforate; base acutely rounded; aperture dilated anteriorly; lip scarcely produced; columella short, imperforate. Alt. 4, diam. 2 mill. (*Gld.*).

China Seas.

C. melampoides GLD., Proc. Bost. Soc., vii, p. 140; Otia, p. 113.

C. GRANULUM Philippi. *Unfigured.*

Shell small, ovate-conic, subperforate at both ends, much attenuated above, rounded at base and transversely striated, the rest of the shell very smooth; milk white; aperture very narrow above, linear, strongly dilated at base, obsoletely plicate; outer lip produced far over the vertex above. Alt. $1\frac{1}{3}$, diam. $\frac{3}{4}$ lines. (*Phil.*).

China (Largilliert).

Bulla granulum Ph., Zeitschr. f. Mal., 1851, p. 63.

Indo-Pacific Species.

C. CONCINNA A. Adams. Pl. 59, fig. 10.

Shell ovately cylindrical, below somewhat acuminate, white, shining, opaque, very minutely transversely spirally striated; apex deeply umbilicated, aperture linear, a little dilated below; columella slightly sinuous, plait obsolete, outer lip produced, extending beyond the apex. (*Ad.*).

Manila, 3 fms. (Cuming); *Matoza Harbor, Japan*, 6 fms. (St. John).

B. (*Cylichna*) *concinna* Ad., Thes. Conch., p. 593, pl. 125, f. 142. —*C. concinna* E. A. Smith, Ann. Mag. N. H., (4), xvi, p. 113.

C. brevissima A. Adams. Pl. 40, fig. 92.

Shell ovately cylindrical, a little contracted in the middle, transversely spirally striated; apex umbilicated, umbilicus partly covered by the columellar callus; aperture narrow, linear, contracted in the middle, above produced, below dilated; columella reflexed, rather callous. (*Ad.*).

China Sea, (Cuming); *Sea of Japan* (Ad.).

B. (*Cylichna*) *brevissima* Ad., Thes., p. 593, pl. 125, f. 144.—*Haminea brevissima* A. Ad., Ann. Mag., (3), ix, p. 155.

C. pyramidata A. Adams. Pl. 27, fig. 88.

Shell subcylindrical, acuminated above, hardly dilated at the base, white, shining, longitudinally grooved, faintly striated transversely above and below; spire hardly obvious, apex deeply umbilicated; aperture narrowly linear, produced above, dilated below; columella reflected, rather callous, umbilicus covered. (*Ad.*).

China Sea (Cuming).

B. (*Cylichna*) *pyramidata* Ad., Thes., ii, p. 595, pl. 25, f. 149.

Jeffreys says that this is the same as *Cylichna* (or *Retusa*) *striatula* Forbes.

C. involuta A. Adams. Pl. 27, fig. 83.

Shell cylindrical, posteriorly truncated, white, solid, transversely entirely striated; aperture narrow, linear; outer lip straight, its angle produced, rounded; inner lip anteriorly tortuous, with a single fold. (*Ad.*).

China Sea (Cuming).

B. (*Cylichna*) *involuta* Ad., Thes., ii, p. 595, pl. 125, f. 151.

This is not the *Cylichna involuta* Nevill, which is a species of *Tornatina*.

C. biplicata A. Adams. Pl. 27, fig. 85.

Shell cylindrical, slender, posteriorly somewhat rounded, engraved with rather distant spiral striæ; apex deeply umbilicated; aperture narrow, linear, produced above, dilated below; columella callous, with two plaits; covered with a reddish-brown epidermis. (*Ad.*).

China Sea (Cuming); *Suez* (Cooke).

C. biplicata Ad., Thes., p. 593, pl. 125, f. 143.—Cooke, Ann. Mag. N. H., (5), xvii, p. 128.

C. mongii Audouin. Pl. 27, fig. 96.

Shell quite small, delicate, ovate-cylindric, slightly more contracted below than above, white, smooth, not striate nor sulcate, a little shining; apex concave, not perforated; aperture narrow, a little larger below than above; right margin regularly arcuate, simple, rising above the vertex at the upper part; visible portion of the columella quite short and not truncated. Alt. 2, diam. 1 mill. (*Issel*).

Red Sea.

Savigny, Desc. de l'Egypte, pl. v, f. 7.—*Bulla mongii* Aud., Expl. des Pl. de Savigny, etc., p. 178, 1827.—*Cylichna mongii* Issel, Mal. Mar Rosso, p. 170.

C. bacillus Ehrenberg. *Unfigured.*

Shell cylindrical thin, transversely striated throughout, white; lip adnate above, not plicate, the other end rounded. One empty specimen seen, which is in the Berlin Museum. Length 4¾, width 2 lines. Aperture extends beyond the body at both ends; lip not inflexed; spire not umbilicate. (*Ehrenb.*).

Red Sea.

Bulla bacillus Ehrenb., Symb. Phys., *Bulla*, sp. 6.

C. pulvisculus Ehrenberg. Pl. 27, fig. 95.

Shell semilinear, oblong, cylindrical, thin, transversely striated at both ends, dull whitish; lip adnate above, not plicate, rounded at the other extremity. Alt. ⅔, diam. ⅓ lines. (*Ehrenb.*).

Arabian shore of the Red Sea; Suez.

Bulla pulvisculus Ehrenb., Symb. Phys., Anim. Evert., *Bulla*, no. 8.—*Cylichna pulvisculus* Issel, Mal. Mar Rosso, p. 169.—Cooke, Ann. Mag. N. H., (5), xvii, p. 128.—Savigny, Descr. de l'Egypte, t. v, f. 6.—*Bulla desgenettii* Audouin, Expl. Pl. Savigny, p. 178, (1827).—*Bulla (Cylichna) pulvisulcus* A. Ad., Thes. ii, p. 602.

C. mica Ehrenberg. Pl. 27, fig. 94.

Shell semilinear, cylindrical, thin, longitudinally striated throughout, not transversely sculptured, white, the lip adnate above, not plicate, rounded at the other extremity; spire flat. Alt. ⅔, diam. ⅓ of a line. (*Ehrenb.*)

Red Sea; Suez.

Bulla mica EHRENB., Symb. Phys., *Bulla*, no. 7.—*Cylichna mica* ISSEL, Mal. Mar Rosso, p. 169.—*Bulla fourieri* AUD., Expl. pl. Savigny, p. 178.—SAVIGNY, Descr. pl. v, f. 5.

The figure of Savigny, which is the only illustration yet published, evidently represents this species, says Issel, but does not show the characteristic longitudinal striæ.

In the case of this species as well as the preceding, Issel adopts Ehrenberg's name instead of the earlier one of Audouin, evidently because Ehrenberg gave descriptions.

C. VILLIERSI Audouin. Pl. 27, fig. 98; pl. 59, fig. 7, (*minuta*).

Shell quite small, fragile, translucent, a little attenuated below, not striated; apex flattened. Spire two whorled, the second of which does not completely envelope the first; last part of the second whorl divided from the body of the shell by a profound sinus; aperture linear, narrower in the middle and above than toward the base; right margin subrectilinear; left margin almost rectilinear above, sinuous below. Alt. 1, diam. ½ mill. (*Issel*).

Red Sea.

SAVIGNY, Descript. de l'Egypte, Coq., t. v. f. 4.—*Bulla villiersi* Aud., Expl. des Pl. de Savigny, xxii, p. 178, 1827.—*Cylichna villiersi* ISSEL, Mal. Mar Rosso, p. 170.—COOKE, Ann. Mag. N. H., (5), xvii, p. 128.—? *Cylichna minuta* H. ADAMS, P. Z. S., 1872, p. 11, pl. 3, f. 10.—*Conf.* Ann. Mag., (5), xvii, p. 129.

The *C. minuta* is thus described: "Shell cylindrical, thin smooth, subpellucid; aperture linear, dilated anteriorly, columella short, simple; lip a little produced behind, the margin arcuate. Alt. 1½, diam. ½ mill. Red Sea."

C. PERPUSILLA E. A. Smith. *Unfigured.*

Shell very minute, oblong-ovate, wider above than at the base, pellucid, smooth throughout, shining; aperture moderately wide above, produced above the vertex, a little dilated at base. Vertex imperforate, slightly depressed through the rising of the lip; columella slightly thickened, scarcely twisted. Al. 1½, diam. ¾ mill. (*Sm.*).

Persian Gulf, 14 fms. (Col. Pelly).

C. perpusilla SM., Ann. Mag. N. H., (4), ix, p. 353.

One of the smallest forms yet discovered. It is quite smooth, white and shining, of an oval form, rather narrower at the base than toward the vertex. (*Sm.*).

C. PUMILISSIMA E. A. Smith. *Unfigured.*

Shell very minute, shortly cylindrical, somewhat contracted in the middle, quadrate above, white, with curved longitudinal liræ; vertex umbilicate, with rounded margin; aperture narrowed above, very much dilated at base; columella spirally twisted. Alt. 1¼, diam. ¾ mill. (*Sm.*).

Persian Gulf, (Col. Pelly).

C. pumilissima SM., Ann. Mag. N. H., (4), ix, p. 352.

This species was dredged by Col. Pelly in great numbers at a depth of 14 fms. It is remarkable for its minuteness, the longitudinal curved ridges, and the very dilated aperture towards the base. (*Sm.*).

C. CONSANGUINEA E. A. Smith. *Unfigured.*

Shell very minute, elongate-cylindrical, white, longitudinally curvedly striate; vertex umbilicated, surrounded by an acute carina; aperture narrow above, moderately dilated below; lip a little contracted in the middle; columella spirally folded. Length 1½, diam. ⅔ mill. (*Sm.*).

Persian Gulf, 14 fms., (Col. Pelly).

C. consanguinea SM., Ann. Mag. N. H., (4), ix, p. 352.

This species differs from *C. pumilissima* in being much more elongate, and in having an acute keel around the vertical umbilicus; the basal part of the aperture is also less dilated. (*Sm.*).

C. LABIATA Watson. Pl. 30, figs. 3, 4.

Shell small, strong, oval, obliquely truncate above, where the apex is impressed, bluntly pointed in front, obscurely angulated above the middle, umbilicate, finely and closely striate, with a thickened lip posteriorly produced. Sculpture: Longitudinals—there are fine, straight, hair-like unequal lines of growth. Spirals—there are fine spiral lines, which at the top and bottom of the shell are a little strong and remote, but in all the center part are very faint and crowded, and above the middle where a very blunt angulation occurs, they are nearly invisible. Color translucent white, with a tinge of brown, which on the outer base is ochreous. Mouth long, curved, narrow, a little enlarged in front; outer lip rises perpendicularly from the outer edge of the impressed apex, is produced posteriorly, where it bends in toward the apex, and is patulous and almost emarginate; its direction and edge line are

both somewhat flexuous; in front it is contracted in towards the pillar, forming at the point of the base a narrow, patulous, but not emarginate gutter; the edge is sharp, but is strengthened a little way within by a small longitudinal rib, which is of a ruddy white color. Top obliquely truncate, small, with a blunt keel round the edge of the minute, shallow, conical depression, which is half choked by the outer lip. Inner lip: a very thin glaze extends across the gibbously and convexly curved body; there is a slight angle at the top of the pillar, which is direct, a little oblique, hardly patulous, scarcely twisted, very narrow, most feebly toothed and truncate in front; behind the sharp edge is a small but deep umbilicus. Alt. 0·16 in. diam. 0·09. Mouth, breadth at same place 0·01 inch. (*Wats.*).

Amboina, 15–25 fms.

C. labiata Wats., Chall. Rep. Gastr., p. 669, pl. 50, f. 4.

This is a very peculiar form, extremely like an *Ovula* both in shape and in the thickness of the outer lip, the edge of which, however, is sharp. (Wats.).

C. concentrica A. Adams. Pl. 27, fig. 87.

Shell small, subcylindrical, elongated, a little dilated at the base, white, longitudinally somewhat sulcated, engraved with very distinct transverse striæ; spire conspicuous, immersed in the apex, periomphalus radiately striated; aperture narrow, linear, produced above, dilated below; columella simple. (*Ad.*).

Cagayan, Philippines (Cuming); *Darnley Island, Torres Straits* (Brazier).

B. (*Cylichna*) *concentrica* Ad., Thes., p. 594, pl. 125, f. 146.—*Cylichna concentrica* Braz., P. L. S., N. S. W., ii, p. 80.

C. strigella A. Adams. Pl. 48, fig. 14.

Shell cylindrical, posteriorly somewhat rounded, engraved with very fine undulating transverse striæ; apex minutely teretely umbilicated, deeply perforated, periomphalus solid, white; outer lip a little receding; columella callus, fold distinct; either nude and shining, or covered with a fuscous epidermis. (*Ad.*).

Cagayan, Philippines, 25 fms. (Cuming); *Torres Straits, N. E. Australia* (Brazier).

Bulla (*Cylichna*) *strigella* A. Adams (not Lovén), Thes. Conch., ii, p. 592, pl. 125, f. 141.—*C. strigella* Braz., Proc. Linn. Soc., N. S. W., ii, p. 80.

This is evidently not the *Cylichna strigella* of Lovén, which is a synonym of *Retusa umbilicata*.

C. DECUSSATA A. Adams. Pl. 27, fig. 82.

Shell small, subcylindrical, elongated, slightly dilated at the base, white, crossed with longitudinal and transverse striæ; spire conspicuous, immersed in the umbilicated apex, peromphalus radiately striated; aperture narrow, linear, produced superiorly, dilated below; columella simple (*Ad.*).

China Sea (Cuming); *Suez* (Cooke); *Darnley Island, Torres Strait* (Brazier).

B. (*Cylichna*) *decussata* AD., Thes. p. 594, pl. 125, f. 147.—*Cylichna decussata* COOKE, Ann. Mag. N. H. (5), xvii, p. 128.—BRAZIER, P. L. S. N. S. W. ii, p. 80.

C. BRAZIERI Pilsbry, n. n. *Unfigured.*

Shell cylindrical, small, white, thin, contracted in the middle, longitudinally and transversely rugosely striated; whorls 3½, apex umbilicated, deep; aperture narrowly linear, peristome thin, contracted in the center, slightly produced above, expanded below, columella thickened, straight, slightly reflected. Length 1¼, diam. at base ¾, above the center ½ line (*Braz.*).

Darnley Island, Torres Straits, 30 fathoms.

Cylichna minuta BRAZIER, Proc. Linn. Soc. N. S. Wales, ii, p. 80, 1877. Not *C. minuta* H. Adams, 1872.

Two specimens found. The apex of this beautiful little species is quite depressed or truncated, and the umbilicus of the apex sunk deep down; somewhat allied in sculpture to *C. decussata* (*Braz.*).

C. CRISPULA Watson. Pl. 30, fig. 12.

Shell narrowly oblong, more contracted above than below, with the greatest breadth below the middle, obliquely truncate above and below, thin, translucent, glossy, very faintly spirally striate all over; the top is like that of a Volvula, but beside the prominent lip the axis is perforated; there is a strong pillar tooth. Sculpture: Longitudinals—the lines of growth are very slight and unequal. Spirals—the whole surface is covered with very slight, superficial fretted, rather unequal, and somewhat remote furrows. Colour translucent glossy milk-white. Mouth long and narrow above, rising and retreating at the top of the shell, widening in front, but not very large even there. Outer lip rises from the edge of the axial pore, and

forms the top of the shell ; at this point it is narrowly rounded and retreats very much, below this its edge advances and its direction is obliquely forward to the right ; in front it retreats rather rapidly and sweeps freely round the base to the point of the pillar ; it is a little bent in about the middle, but is very patulous on the base. Top is very small, and fully half of it is covered by the lip, but behind this there is a minute conical depression with a defined rounded edge. Inner lip is regularly arched on the body, where there is a thin glaze, which becomes thick on the pillar with a twisted sharply defined edge. Pillar bears a strong, almost direct tooth, with a well marked broad furrow between it and the lip edge. Alt. 0·16 in., diam. 0·075. Mouth, breadth at same place 0·017 inch (*Wats.*).

Raine Island, Cape York, N. Australia, 155 fms.

C. crispula Wats., Chall. Gastr. p. 666, pl. 49, f. 12.

This species is deceptively like a *Volvula*. In general form it resembles *Atys parallela* (Gould), but is smaller, is more contracted above, and is there minutely perforated ; the tooth in front, too, is stronger, and the spiral sculpture is much finer (*Wats.*).

C. reticulata Watson. Pl. 30, figs. 5, 6.

Shell small, oblong to subcylindrical, harshly reticulated, white, with a narrow scarcely curved mouth, a lip produced posteriorly, an oblique perforated top, a subpatulous direct and oblique pillar lip reverted on a narrow umbilicus. Sculpture : Longitudinals—the whole surface is scored with strong rounded furrows, which follow the lines of growth and are parted by interstices about once and a half their width. Spirals—similar to the longitudinals, but rather stronger and further apart, are spiral furrows, the intersection of which with the longitudinals cuts the surface into square reticulations. Colour translucent white. Mouth long and narrow, widening very little in front, curved a very little throughout its whole length. Outer lip rises above the top, bending a little in toward the perforation ; in direction it is slightly curved throughout, its edge retreats somewhat above, in the middle, and in front. Top is small, oblique, with a slightly expressed, narrowish, thickened, harshly radiatingly scored rim, within which is a funnel-shaped perforation. Inner lip : a thickish glaze crosses the well-arched body and runs out on the slightly patulous, direct, oblique prominent and narrow-edged pillar, behind which and half covered

by it is a furrow running up into the umbilicus. Alt. 0·11 in., diam. 0·05. Mouth breadth at same place, 0·009 inch (*Wats.*).

Wednesday Island, off Cape York, 8 fms., *and near Cape York, N. Australia*, 6 fms.

C. reticulata Wats., Chall. Rep. Gastr. p. 667, pl. 50, f. 2.

This is a remarkable species, with very exceptional sculpture. The apical pore is so choked with impacted sand that it is impossible to say whether the spire be visible or not (*Wats.*).

C. subreticulata Watson. Pl. 30, figs. 8, 9.

Shell small, oblong, subreticulated, white, with a narrow covered mouth, a lip slightly produced posteriorly, an oblique perforated top, a short patulous subtwisted pillar, round whose base is a slight fold, and whose edge is appressed. Sculpture: Longitudinals—there are irregular and not strong lines of growth. Spirals—there are coarse, but feeble, rather remote furrows which cover the whole surface. Colour translucent white. Mouth curved, a little broader above and below than in the middle. Outer lip rises very little above the top, bending out, a very little yet at once, from the apical pore; it is strongly curved throughout. Top is small, slightly oblique, with a scarcely definite, feebly scored rim, within which is a funnel-shaped perforation. Inner lip: a thin glaze, with an irregular edge, spreads across the body, which is well rounded; round the top of the oblique pillar is a feeble furrow and fold; the lip edge is appressed, and has behind it a very slight depression, but no umbilicus. Alt. 0·106 in., diam. 0·056. Mouth breadth at same place 0·013.

West of Cape York, N. Australia, 6 fms.

C. subreticulata Wats., Chall. Gastr. p. 668, pl. 50, f. 3.

This species is very like *Cylichna reticulata*, but differs from it in that the shell is broader in proportion to length; the mouth is broader and more curved; the strongly reticulated sculpture is absent, what there is being much feebler and less regular, this is especially the case with the longitudinal furrows; the outer lip rises less high behind and does not lean in at all to the perforation; the edge of the top is less oblique; the pillar lip has a fold at its base, and the lip edge is reflected and appressed, and has no umbilicus behind it (*Wats.*).

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C. ARACHIS Quoy & Gaimard. Pl. 27, figs. 92, 93.

Shell solid, long cylindrical, transversely very delicately striated; white, covered with a cinnamon colored epidermis; spire perforated. Alt. 8, diam. 3½ lines (*Q. & G.*).

King George's Sound (Q. & G.); *Tasmania* (Tenison-Woods); *Port Jackson, N. S. Wales* (Angas, Coppinger, Challenger, et al.); *Cape York and New Guinea* (Brazier).

Bulla arachis Q. & G., Voy. de l'Astrol. Zool. ii, p. 361, pl. 26, f. 28–30.—*Bulla* (*Cylichna*) *arachis* AD., in Thes. ii, p. 590, pl. 125, f. 133, 134.—*Cylichna arachis* ANGAS, P. Z. S. 1867, p. 226.—BRAZIER, P. L. S. N. S. W. ii, p. 79.—SMITH, Zool. Coll. Alert, p. 86.—WATSON, Challenger Rep. Gastr. p. 662.—*Cylichna regularis* GLD., Proc. Bost. Soc. N. H. vii, p. 141; Otia, p. 113. *Conf.* TENISON-WOODS, Proc. Linn. Soc. N. S. Wales ii, p. 256.

C. ATKINSONI Tenison-Woods.

Shell small, cylindrical, narrow, thin, ferruginous, spire umbilicate, hidden, very slenderly lengthwise and transversely striate. Sordid white, outer lip thin, acute, drawn in at the middle, and subdilate anteriorly; inner lip narrow, reflexed (*T.-W.*).

Alt. 4½, diam. 2 mill.

Long Bay, Tasmania.

C. atkinsoni T.-W., Papers and Proc. and Rep. Roy. Soc. Tasm. for 1875, p. 156 (1876).

A very small shell, brought up occasionally by the dredge from 10 fathoms; sandy bottom. The other Tasmanian species is *C. arachis*, which is Australian also. In its young state it can always be distinguished from the foregoing by the dense undulating transverse striæ with which it is covered (*T.-W.*).

C. ELEGANS Angas. Pl. 27, fig. 89.

Shell elongately ovate, umbilicated, rather thin, white, irregularly and faintly longitudinally striated, the striæ more distinct and equal near the apex, transversely ornamented with numerous rows of very fine close-set, crenate, interrupted lines, which, together with the longitudinal striæ, become very nearly obsolete towards the center; apex perforate, somewhat tumid around the perforation; aperture narrow above, wider below; outer lip thin, simple; columella short, smooth, very slightly expanded over the umbilicus. Length 6, breadth 3 lines (*Ang.*).

Port Stephens, N. S. Wales, Australia (Brazier).

Cylichna elegans Ang., P. Z. S. 1877, p. 175, 189, pl. 26, f. 19.

More ovate than others of the genus; beautifully transversely crenulately sculptured (*Ang.*).

C. pygmæa A. Adams. Pl. 59, fig. 9.

Shell small, subcylindrical, contracted in the middle, apex umbilicated, white, shining, smooth, longitudinally striated; outer lip posteriorly produced, rounded, inflexed in the middle; inner lip anteriorly subcallous; aperture narrow, linear, anteriorly dilated (*Ad.*).

Port Lincoln (Mus. Metcalfe); *St. Vincent's Gulf* (Tate); *Sea of Japan* (A. Ad.).

B. (*Cylichna*) *pygmæa* A. Adams, Thes. ii, p. 595, pl. 125, f. 150. —Tate, Trans. and Proc. and Rep. Philos. Soc. Adelaide, S. Austr. 1878–9, p. 138.—*Haminea pygmæa* A. Ad., Ann. Mag. N. H. (3), ix, p. 155.

C. ordinaria E. A. Smith. Pl. 27, fig. 90.

Shell cylindrical, white, shining, imperforate, the excavation at the apex scarcely profound, encircled by an impressed carina; aperture very narrow, dilated below, subtruncate; columella somewhat twisted, excavated, surrounded by a keel. Alt. 7, diam. 3 mill. (*Sm.*)

S. lat. 34° 13′, *E. lon.* 151° 38′, *off Sydney, N. S. Wales*, 410 fms.

Cylichna ordinaria Sm., P. Z. S. 1891, p. 442, pl. 35, f. 21.

The distinguishing character of this species is the excavation of the lower part of the columella, which is circumscribed by a keel, a continuation of the inner lip (*Sm.*).

C. striata Hutton. Pl. 59, figs. 11, 12.

Shell cylindrical, with slightly convex outlines; showing some unevenly spaced growth lines, and an excessively fine spiral striation, which is coarser at the crown, and becomes coarser and spaced toward the base. Vertex abruptly truncated; the whorl rounded above, passing into a funnel-shaped apical umbilicus, the edge of which is defined by a sort of keel or ledge; the perforation narrow and deep. Aperture narrow in its upper two-thirds, dilated below; outer lip rising above the vertex, nearly rectilinear in the middle, or even slightly incurved, rounded below; columella sloping, rather

heavily calloused and slightly tortuous; parietal wall lightly calloused. Alt. 7½, diam. 3 mill.

Auckland, New Zealand (Hutton, Wright).

Cylichna striata HUTTON, Cat. Mar. Moll. N. Z. p. 52; Manual N. Z. Moll. p. 120.—*C. arachis* HUTTON, The Pliocene Moll. N. Z. p. 37.

The above description and the figures are drawn from Auckland specimens sent by Mr. G. W. Wright. They seem to differ from *C. arachis* in the narrower apical umbilicus. Hutton's description of *C. striata* is as follows: "Small, smooth, white, longitudinally finely striated; aperture scarcely produced above the spire. Length ·1, breath ·05 inch." This would indicate a much smaller form than mine, which may prove distinct.

C. ZEALANDICA Kirk. *Unfigured.*

Shell white, strong, smooth, faintly longitudinally striated. Aperture produced above the spire. Alt. ·35 inch (*Kirk*).

Waikanae, New Zealand.

Cylichna zealandica KIRK, Ann. Mag. N. H. (5), vi, p. 15; Trans. N. Z. Inst. xii, p. 307.

Compare *C. striata.*

C. TAHITENSIS Watson. Pl. 30, fig. 10.

Shell cylindrical, thin, glassy, spirally striate from end to end, with a small body, rounded outlines, no depression nor central point at the apex, and a toothless but abruptly truncated and prominent pointed pillar. Sculpture: Longitudinals—there are scarcely perceptible lines of growth. Spirals—the whole surface is covered with fine grooves, not quite regular, about $\frac{1}{200}$ inch apart, but weaker and more crowded in the middle than at either extremity. Color bluish transparent glossy white. Mouth rather large and long. Outer lip has a sinus just above the body, rises and is angulated at the outer upper corner of the shell; from this point its edge advances and its line is slightly convex, tending in front to become straight; at the lower outer corner it is angulated, and across the base is abruptly truncate. Inner lip has a very thin glaze, it is flatly convex on the body, straight and elongately oblique on the pillar, which presents no tooth, but has a thin, defined, hardly twisted edge, and is abruptly cut off in front, being there a strong

prominent point. Alt. 0·083 in., diam. 0·044. Mouth breadth at same place 0·007 inch (*Wats.*).

Tahiti Harbor, near the reefs, 20 fms.

C. tahitensis Wats., Chall. Rep. Gastr. p. 665, pl. 49, f. 11.

This is very possibly a young shell.

C. fijiensis E. A. Smith. *Unfigured.*

Shell very much elongated, narrow, cylindrical, a little contracted in the middle, white, transversely very finely striated, the striæ more distant toward the vertex, longitudinally striated with indistinct growth lines. Vertex (which is surrounded by an acute margin) profoundly umbilicate; base subperforate. Aperture very narrow above, dilated below; columella a little thickened, spirally twisted, joined to the apex by a thin callus. Alt. 6, diam. 2 mill. (*Sm.*).

Fiji Is.

C. fijiensis Sm., Ann. Mag. N. H. (4), ix, p. 352.

A pure white shining species, of nearly the same form as *C. biplicata* A. Ad., but rather narrower, with the columella only spirally twisted, and the transverse striæ finer (*Sm.*).

C. nitens E. A. Smith. *Unfigured.*

Shell ovate, semi-pellucid, bluish-white, shining, longitudinally indistinctly and transversely at top and base striated. Vertex minutely umbilicated. Aperture narrow, dilated at base; lip solid, thick; columella thick, provided with a small tooth or tubercle in the middle; umbilical region subperforate. Alt. 5, diam. 2½ mill. (*Sm.*).

Fiji Is.

C. nitens Sm., Ann. Mag. N. H. (4), ix, p. 351.

A small semitransparent bluish-white species, chiefly characterized by the thick labrum and columella which has a small tooth or tubercle on the middle of it (*Sm.*).

Var.: Shell larger, less solid; alt. 6, diam. 3 mill.

South African and South Atlantic Species.

C. tubulosa Gould. *Unfigured.*

Shell of moderate size, elongated, cylindrical, sensibly enlarged above and below, whitish; smooth or sculptured with revolving

lines; vertex obliquely truncated, crateriform, imperforate. Aperture very narrow, linear; columellar fold conspicuous. Alt. 8, diam. scarcely 3 mill. (*Gld.*).

Simon's Bay, Cape of Good Hope.

C. tubulosa Gld., Proc. Bost. Soc. vii, p. 140; Otia, p. 113.

Allied to *C. involuta* Ad., but the outlines are more rectilinear (*Gld.*).

C. atlantica E. A. Smith. Pl. 27. fig. 97.

Shell ovate-cylindrical, thin, pellucid-white, shining, rimate, narrowly perforated at the vertex, transversely very delicately striated, especially above and below. Aperture very narrow above, slightly dilated below; lip thin, produced above the vertex; columellar margin covered with a thin reflexed callus, obsoletely subtruncate below. Alt. 5½, diam. 2½ mill. (*Sm.*).

St. Helena.

Cylichna atlantica Smith, P. Z. S. 1890, p. 297, pl. 24, f. 10.

This species has more curved outlines than *C. cylindracea*, has a perforate apex, and an umbilical chink. The thin columellar callosity extends up the whorl, and joins the upper extremity of the outer lip (*Sm.*).

Species of unknown habitat.

C. sarsii (Phil.) A. Adams. Pl. 59, fig. 6.

Shell ovately cylindrical, posteriorly truncate, anteriorly produced, apex perforated, white, transversely very finely striated; aperture narrow; columella anteriorly with a single fold; outer lip posteriorly produced (*Ad.*).

Habitat unknown (Mus. Hanley).

B. (*Cylichna*) *sarsii* Phil., A. Ad., Thes. ii, p. 591, pl. 125, f. 135.

I cannot find that Philippi ever described this species.

C. lacteocincta E. A. Smith. *Unfigured.*

Shell minute, cylindrical, pellucid, encircled by several interrupted milky bands; with longitudinal, very fine, curved striæ, and transversely striated below; vertex umbilicate, surrounded by a rounded margin. Aperture narrow above, sensibly dilated below; columella thickened, obliquely subtruncate. Alt. 2½, diam. 1¼ mill. (*Sm.*).

Habitat unknown.

C. lacteocincta Sm., Ann. Mag. N. H. (4), ix, p. 352.

This species may be at once recognized by the lacteous bands upon a hyaline ground, and by the peculiar subtruncation of the columella, which almost forms a short channel with the outer lip (*Sm.*).

Subgenus MNESTIA H. & A. Adams, 1854.

Mnestia ADS., Genera Recent Mollusca ii, p. 10 (for *C. bizona* and *C. marmorata*).

This group is at present restricted to species with variegated coloration.

C. MARMORATA A. Adams. Pl. 27, fig. 86.

Shell ovate, contracted above, produced and rather acuminate below, smooth, shining, variegated with pale red-brown and white, the spots in some specimens disposed in distinct bands, transversely very minutely striated; striæ most distinct above and below; spire conspicuous, in the deep umbilicus of the apex; aperture narrow, acuminately produced above and below; columella straight, rather callus, umbilicus distinct (*Ad.*).

Capul, Philippines.

B. (*Cylichna*) *marmorata* AD., Thes. p. 594, pl. 125, f. 145.

C. BIZONA A. Adams. Pl. 27, fig. 84.

Shell ovately cylindrical, fulvous, encircled with two pale red brown bands, longitudinally obsoletely plicated, engraved with distinct transverse finely undulated striæ; spire immersed in the deep umbilicus of the apex; aperture produced above, linear, dilated inferiorly; columella slightly plicated, rather reflected, umbilicus covered; outer lip inflexed superiorly (*Ad.*).

Alt. 5, diam. 2·2 mill.

China Sea (Cuming); *Singapore* (Dr. S. Archer); *Levuka, Fiji* (Challenger); *Torres Strait* (Brazier).

Bulla (*Cylichna*) *bizona* A. AD., Thes. ii, p. 595, pl. 125, f. 148. —*Cylichna* (*Mnestia*) *bizona* H. & A. AD., Genera, ii, p. 10.—WATSON, Challenger Gastrop. p. 671.—*Mnestia bizona* BRAZ., P. L. S. N. S. W. ii, p. 81.

In the specimens from Singapore before me the bands are a little more widely spaced than in Sowerby's figure.

C. GRANOSA Brazier. *Unfigured.*

Shell small, ovate, light straw yellow, variegated with two nearly obsolete white bands, in some specimens not visible, contracted above, produced and rather acuminate below; longitudinally and transversely rugosely striated, interstices smooth, the whole surface of the shell having the appearance of somewhat square-like grains, spire conspicuous in the deep umbilicus of the apex, outer margin of the umbilicus white and very rugose; aperture narrow, acuminately produced and thickened above, slightly produced below; columella thickened, straight, slightly reflected, umbilicus minute, with a white margin, peristome moderately inflexed. Length 2 lines, breadth 1 line (*Braz.*).

Darnley Island, Torres Straits, 30 fathoms.

Mnestia granosa BRAZ., Proc. Linn. Soc. N. S. W. ii, p. 81, 1887.

The whole surface of this species is covered with a series of small grains, after the style of a double cut file (*Braz.*).

C. PUNCTOSULCATA E. A. Smith. *Unfigured.*

Shell wide ovate, a little narrowed at the base, thin, scarcely pellucid, brown-white, transversely delicately sulcate, sulci 27, equidistant, closely punctate. Vertex umbilicate, striated within, surrounded by a rounded margin. Aperture wide, a little produced above the vertex; lip thin; columella thickened, sinuous; umbilical region subperforate. Alt. 4½, diam. 3 mill. (*Sm.*).

Tunis, North Africa.

C. (*Mnestia*) *punctosulcata* SM., Ann. Mag. N. H. (4), ix, p. 353.

This appears to be very distinct from any other species; and it is at once recognized by the 27 closely punctured striæ, which are at equal distances from each other (*Sm.*).

C. ALBOGUTTATA E. A. Smith. *Unfigured.*

Shell ovate, somewhat attenuated at base, thin, semipellucid; whitish, closely ornamented with opaque milky spots; smooth, shining, finely striated with growth lines and transverse lines, more distinct above and at the base. Vertex deeply umbilicated, transversely striated within, surrounded by a rounded margin; aperture rather wide above, wider at base; lip thin; columella thickened, white, reflexed, nearly closing a small fissure. Alt. 8, diam. 4½ mill. (*Sm.*).

West Indies.

C. (*Mnestia*) *alboguttata* Sm., Ann. Mag. N. H. (4), ix, p. 353.

Var.: Pale roseate, variegated with numerous round white blotches.

This species is at once known from *marmorata* A. Ad., by the difference of form. It is without the contraction just below the vertex, the apical umbilicus is smaller and not surrounded by so sharp an edge, the striæ above and below are not so strongly marked, and the aperture is not so produced upwards as in that species (*Sm.*).

Subgenus Cylichnella Gabb, 1872.

Cylichnella Gabb, Proc. Acad. Nat. Sci. Phila. 1872, p. 273, type *C. bidentata.*

The soft parts of the species are unknown; so that we do not yet know whether this group belongs to *Tornatinidæ* or to *Scaphandridæ.*

C. bidentata Orbigny. Pl. 22, fig. 42; pl. 27, fig. 9.

Shell minute, oblong-oval, shining, smooth, except for indistinct growth striæ, and sparse, impressed, spiral lines at the basal part. Spire concealed; body whorl tapering at both ends; aperture as long as the shell, very narrow, widened below; columella short, with a spiral callous fold, and an indistinct nodule below.

Alt. 2·6, diam. 1–4 mill.

Cape Hatteras to S. Domingo and Barbados, 7–168 fms.; *Florida to Texas,* near low water mark; *St. Helena.*

Bulla bidentata Orb., Moll. Cuba i, p. 125, pl. 4, f. 13–16 (1841). —*Cylichnella bidentata* Gabb, Proc. Acad, Nat. Sci. Phila. 1872, p. 273, pl. 10, f. 2.—Morch, Malak. Bl. xxii, p. 171.—Dall, Blake Gastr. p. 46.—*Bulla biplicata* Lea, Proc. Bost. Soc. N. H. i, p. 204 (1844); Bost. Journ. Nat. Hist. v, p. 286, pl. 26, f. 2.—*Utriculus biplicatus* Tryon, Amer. Mar. Conch. p. 104, pl. 13, f. 213.—*Cylichna biplicata* Bush, Trans. Conn. Acad. vi, p. 467, pl. 45, f. 14.—*Cylichna bidentata* Orb., Smith, P. Z. S. 1890, p. 297.

C. oryza Totten. Pl. 22, fig. 39 (enlarged).

Shell not very small, not very thin, translucent, white, regularly diminishing from the middle towards each end, the tip being depressed into a shallow pit, and the front being rather pointed; last whorl enclosing all the others; surface marked with minute lines of growth, a few revolving lines on the anterior portion, and a few

more obscure ones near the shoulder, none of them perceptible without a magnifier; aperture as long as the shell, narrow behind, and widening forward; outer lip simple and sharp, commencing beyond the axis of the shell and rising a little, then turns and passes forwards by a regular curve; the left margin is thickened and forms a smooth, glossy pillar, which is twisted so as to form an oblique fold; at the base it terminates abruptly, so as almost to form an obtuse tooth; a thick callus, commencing at the junction of the outer lip, runs round within the whorl, giving strength to the region of the spire. There is no umbilical opening either at the tip or base. Length three-twentieths of an inch, breadth one-tenth of an inch (*Gld.*).

Maine to Connecticut.

Bulla oryza TOTTEN, Silliman's Journal of Science, xxviii, 1835, p. 350, fig. 5.—GLD., Invert. Mass. p. 168, f. 93.—DE KAY, New York Moll. p. 18, pl. 31, f. 327.—*Cylichna oryza* STIMP., Check-Lists p. 4.—GLD., Invert. Mass. (W. G. B. edit.), p. 221, f. 512.—*Tornatina* (*Cylichnella*) *oryza* DALL, Rep. Gastr. p. 45.—*Haminea oryza* SOWB., Conch. Icon. f. 1.

Family BULLIDÆ (Auct.) Pilsbry.

Shell wholly external, globose, oval or oblong-cylindric, with umbilicated vertex (rarely covered) and sunken spire, mottled color-pattern and smoothish surface. Aperture as long as the shell, rising above the vertex, narrow above, dilated below; columella simply concave with reflexed crescentic callus and no fold.

Animal capable of complete retraction into the shell, with a large head-disc, truncated in front, bilobed behind, bearing eyes about in the middle. No epipodial or parapodial lobes; foot long, tapering behind. Stomach containing three dumb-bell shaped horny plates. (pl. 48, fig. 4).

Radula having few longitudinal rows of teeth (formula 1·2·1·2·1), the centrals transverse, bar-shaped with reflexed, multi-dentate cusp, a submedian denticle smaller; laterals two on each side, claw-shaped with numerous denticles. A cusp-less plate lies outside of the outer lateral. (Pl. 48, fig, 4.)

This family, now for the first time separated from its rather distant allies the *Akeridæ*, represents a very distinct line of differentiation from the original Tectibranch stock with many longitudinal rows of similar teeth. In the reduction in number of teeth, and the

specialization in form of those retained, it parallels the *Scaphandridæ;* but the specialization has been in a different direction corresponding to the wide difference in food of the two groups,—*Scaphandridæ* being carnivorous, whilst *Bullidæ* are exclusively herbivorous. The absence of epipodial lobes is also different from *Scaphandridæ*, the animal in *Bullidæ* having the external form of that of *Tornatinidæ*. From both of these families the *Bullidæ* differ moreover, in shell characters, form and non-calcification of the gizzard plates, etc.

The *Akeridæ* are a much lower stock of Tectibranchs than *Bullidæ*, retaining the primitive multi-dentate radula, and the epipodial lobes, and having a thin, fragile unicolored shell.

A few unicolored species, none of them known anatomically, are referred to the genus *Bulla;* but as a rule the shells are well distinguished from all other Tectibranchs by their characteristic mottled coloration.

But one genus is represented in the recent fauna. No extinct groups are known to be referable to this family.

Genus BULLA Linné, 1758.

Bulla L., Syst. Nat. (x), p. 725.—Brug., Encycl. Méth. i, p. 368, and of most modern authors.—*Bullus* Montf., Conch. Syst. ii, p. 330, type *B. ampula.*—*Bullea* Blainv., in part, section B, Malacol., p. 478, and of Menke and Morch, not *Bullæa* Lam.—*Vesica* Swains. Malacol., p. 360.—*Nux*, DaCosta Elem. of Conch., p. 174, 1776 (not binomial).—*Conf.* Vayssiere, Rech. Zool. et Anat. sur les Moll. Opisthobr. 1re pt. Tectibranches, p. 13 (anatomy of *B. striata*).

Shell oval or ovate, compactly involute, generally solid and with a mottled color-pattern; spire sunken, umbilicated. Aperture as long as the shell, rising slightly above the vertex, its upper portion narrow, expanded toward the base; lip simple, flexuous; columella short and concave, with a crescentic white reflexed callus; parietal wall smooth, with a light parietal callus. Type *B. ampulla* L.

Animal capable of complete retraction into the shell. Head-shield rounded in front, produced behind in two rounded posterior processes separated by a median sinus; eyes small, wide apart, about half-way back on the shield. Epipodial lobes wanting. Foot large, nearly as long as the shell, roundly subtruncate behind, wide and blunt in front (pl. 43, figs. 7, 8, *B. quoyi*).

Gizzard containing three subequal nearly similar horny or chitinoid plates which are dumb-bell shaped on the outer surfaces (pl. 48, fig. 15) the inner or grinding surfaces being somewhat truncated wedge-shaped with flat tops (fig. 17). The side view (fig. 16) shows a ledge (where the muscles of the stomach-wall are attached) separating the outer face from the grinding face. The figures represent the plates of *B. nebulosa* Gld. Those of *B. ampulla* are shorter, with the external processes nearer together.

Radula (pl. 48, fig. 4, *B. ampulla*) large, with dark chitinous teeth according to the formula 1·2·1·2·1. Laterals not differentiated from uncini. Rhachidian teeth like a transverse bar, its reflexion bearing numerous denticles of which the median one is smaller. Laterals claw-shaped, with about 6 long denticles. Outside of the second lateral lies a small, thin basal-plate without cusp, the remnant of a third lateral tooth. In *B. nebulosa* Gld. this plate is larger and thicker, but still lacks the cusp. *B. striata* presents a radula and gizzard-plates of the same type.

The Linnæan genus *Bulla* consisted of species of the genera *Ovula*, *Physa*, *Auricula*, *Melampus*, etc., besides the tectibranchiates then known. Bruguière in the Encyclopédie Méthodique eliminated all but the last, which form a perfectly natural group. Finally Lamarck, in the Systême des Animaux sans Vertèbres, 1801, cites only *B. ampulla* L. as an example of the genus, thus fixing that species as the type. The attempts of Menke, Mörch and others to substitute other names for the typical group of species, are therefore without basis.

"The species of this genus inhabit sandy mud-flats, the slimy banks of river-mouths, and brackish places near the sea; at low-water some of them conceal themselves in the mud and under seaweed, exuding large quantities of mucus to maintain the moisture of their skin. The shells of *Bulla*, as restricted, are rather solid, smooth, and marbled and mottled like birds eggs." (*H. & A. Ad.*)

The gizzard of a specimen of *B. nebulosa* Gld. examined by myself contained a mass of vegetable fibers, probably algæ, but no animal remains.

Species of the Mediterranean, Atlantic and Gulf of Mexico.

The littoral Bullas of this area form a very difficult assemblage, requiring a great mass of material for its elucidation. The creatures

themselves are mostly not thoroughly differentiated into "species," if by that term we understand isolated and unconnected races. There are, however, geographically restricted forms which in their average features constitute moderately tangible races; and ratherthan lose sight of these *average* differences which are certainly correllated with geographic range, we have herein recognized the conventional "species" based upon them. To some minds who hold the "species" to be a sacred fetich, the course of the "lumper" would be more acceptable; and they may write all there is of the *striata* group of *Bulla*, under that name. It is simply a question of what degree or grade of racial deviation is worth formal recognition in nomenclature; and this must in the nature of things, remain a question of individual opinion.

(*Group of B. striata*).

Under *B. striata* the genesis of the various races of this group is discussed.

B. AMYGDALA Dillwyn. Pl. 38, figs. 49, 50, 62, 63, 64, 65; pl. 39, fig. 79.

Shell oblong, somewhat cylindrical and narrower toward the vertex, *solid, heavy and strong*, not very shining, clouded and mottled indistinctly with purplish on a pale ground, *more or less obviously spotted or blotched with deep purple or blue-black, the spots shading into the ground color on the left side, whitish-margined on the right side of each.* Surface showing under the lens *no microscopic spiral striation* (such as occurs in *B. striata, occidentalis* and *solida*), but having some *spaced spiral impressed lines toward the base,* and occasionally a few near the vertex, but these are more often absent. Vertex not especially compressed having a deep and rather large apical umbilicus, which is more or less lirate within. *Outer lip thick, heavily calloused where it rises from the vertex;* its outer portion *straight,* not convex; base broadly rounded. Columella arcuate, with *a very heavy reflexed crescentic callus,* the *outer edge of which is well raised from the whorl throughout*, leaving a chink behind it; parietal callus strong and white; interior lined with a white callus. Alt. 40, diam. 23 mill. Some adults are smaller, alt. 26, diam. 15 mill., and others larger, alt. 46, diam. 27 mill.

St. Thomas, Tortola, Curacoa and Gulf of Paria (Robert Swift!); *West Indies generally.*

Bulla ampulla var. GMELIN, SCHROETER et al. *Bulla maculosa, oblonga* MARTINI, Conch. Cab., i, p. 290, pl. 22, f. 202–204, 1769.—*B. ibyx* MEUSCHEN, Museum Geversianum, etc., p. 396, 1787.—*B. amygdalus* DILLW., Descr. Catal. Rec. Shells, i, p. 480.—AD., Thes. Conch. ii, p. 575, pl. 122, f. 63.—MKE., Mal. Bl. i, p. 44.—SOWB., Conch. Icon. f. 7.—*B. striata* ORBIGNY, Moll. Cuba, i, p. 122.—*B. multistriata* A. AD., index to *Bulla*, Thes. Conch. ii, p. 607.—*B. media* PHIL., Zeitschr. f. Mal. 1847, p. 121.—AD. in Thes., f. 70.—SOWB., Conch. Icon., f. 11*a*, 11*b*.—? *Bulla* (*Bullea*) *marginata* MENKE, Mal. Bl. 1853, p. 139.

The name proposed by Meuschen is not adopted because it was unaccompanied by a description, and refers to a very indifferent figure.

The chief characteristics of this species are (1) its solidity, (2) *the absence of microscopic striæ* over the whole shell, (3) the compression of the latter part of the body-whorl, producing a straight outer lip, (4) the thickness of the lip at the vertex, and the very heavy, reflexed columellar callous with elevated edge. Some of these characters, such as the straightened outer lip, occur in *B. occidentalis*; but taking all into consideration, the *B. amygdala* seems to be a moderately well-defined type. In some specimens the blackish spots or clouds coalesce to form longitudinal irregular or curved stripes (fig. 62).

B. RUBIGINOSA Gould. Pl. 39, fig. 76.

Animal with the head flat, compressed, bilobed in front, the lobes semicircular, with a deep fissure between, on each side of which, in a small circular depression and rather remote, are the eyes; posteriorly the head is furnished with two thin, prolonged, subtriangular lobes. The mantle is very narrow, hardly surpassing the edge of the shell. The color of the body is light-ochreous, powdered, as it were, with black. Its motions were sluggish. (*J. P. C.*).

The general contour of the shell is like that of *Bulla amygdalus*, with which it has doubtless been confounded. The animal, however, is very different. In general, the surface was either eroded or covered with a rusty coating, as is most commonly the case with all shells found at the mouths of rivers in brackish waters; when perfect, it is of a light shining brown, clouded with black. (*Gld.*).

Near the mouth of Rio Janeiro Harbor (Couth.).

B. rubiginosa GLD., Proc. Bost. Soc. Nat. Hist. iii, p. 107, Apr., 1849; U. S. Expl. Exped., p. 221, f. 266, 266*a*.—MORCH, Mal. Bl. xxii, p. 174.—*Bulla* (*Bullea*) *sulcata* MENKE, Zeitschr. f. Mal. 1853, p. 138.

I have not seen this species, which is evidently a near ally of *B. amygdala*, if not identical with it. Menke thus describes *B. sulcata*: "Shell oblong-elliptical umbilicated at vertex, rather solid, distinctly and closely, transversely striated below, longitudinally irregularly and more or less obviously subsulcate; lip somewhat straightened in the middle; rufous-ashy. Length 13, diam. 7 lines. *Hab.*, salt lake at S. Pedro dos Indios, near Cabo Frio, coast of Brazil. The deep longitudinal furrows, always most pronounced on the back and outer lip, distinguish this species. The thin callus of the inner lip ascends to the apical umbilicus, sometimes even invading it."

B. OCCIDENTALIS A. Adams. Pl. 38, figs. 51, 52, 53, 55, 56, 57–60; pl. 39, figs. 77, 78.

Shell excessively variable in size, solidity and coloring, but distinguished from *B. striata* by (1) the narrower umbilicus, (2) the absence or obsolescence of transverse grooves near the vertex, (3) the less attenuated posterior end [in all of which it is more like the Algerian variety mentioned under *B. striata*]. It is distinguished from *B. amygdala* by its thinner, more shining, microscopally spiralled shell.

Some forms are small, very thin, fragile, subcylindrical, densely wave-striated spirally throughout, with the basal grooves scarcely differentiated (pl. 38, fig. 60, pl. 39, f. 78, from a Lake Worth, E. Florida specimen). Some are solider, with close zebra stripes (pl. 38, f. 59) as in certain Bahama shells. The prevalent form along the mainland, Texas to Aspinwall and Trinidad, is larger and moderately solid, (1) closely mottled with reddish and white (figs. 51, 52, Vera Cruz) or olivaceous and white, or (2) mottled with olivaceous and clouded with black and white (figs. 53, 55, 56, Progreso, Yucatan). In unworn examples microscopic spiral striæ may be seen over the whole surface, and also basal spaced grooves, but the latter are sometimes very weak and hardly seen on the small thin forms from Florida. The coarser shells sometimes show some

faint grooves above, but this is exceptional. The umbilicus rarely lacks internal liræ, but they are generally weak.

Alt. 11, diam. 6 mill. (typical *occidentalis*, Bahamas).

Alt. 34, diam. 19 mill. (Vera Cruz specimen).

Alt. 21, diam. 12½ mill. (Jamaica specimen of ordinary size).

Entire West Indies; Mainland from Trinidad to Vera Cruz, Corpus Christi, etc., Florida; Bahamas.

B. occidentalis A. ADAMS, in Sowb., Thes. ii, p. 577, pl. 123, f. 72, 73 (1850).—SOWB., Conch. Icon., f. 14.—DALL, Blake Rep., p. 55.—*Bulla alba* TURTON, Zool. Journ. ii, p. 364, pl. 13, f. 6 (worn and bleached specimens, *teste* Dall, from Turton's types).—? *B. perstriata* MKE., Zeitschr. f. Mal. 1853, p. 138.—? *B. nux* MKE., *t. c.*, p. 140.—*B. striata* BRUG. (part of synonymy) and of many authors.

This is the most abundant and universally diffused of the West Indian Bullas. In examining hundreds of examples, covering the entire region, we are unable to separate the small form originally named *occidentalis*, from the larger shells known to collectors as "*B. striata*." Every connecting link occurs. Many of the main patterns of coloring are illustrated on my plate, but there are others; and some have a delicacy quite beyond any published figures.

Bulla (*Bullea*) *tenuicula* Mke., (Zeitschr. f. Mal. 1853, p. 139, and Malak. Bl. i, p. 45, from Puerto Cabello), is probably a form of this species.

B. STRIATA Bruguiére. Pl. 37, figs. 42, 43, 44, 45, 46.

Shell moderately solid, oblong-subcylindrical or oblong ovate, tapering toward the ends; whitish, mottled and clouded all over with purplish and usually showing an indistinct girdle of heavier, darker blotches above the middle; surface smooth, usually showing under a lens an excessively fine, close spiral striation, and having deeper spaced grooves toward the base and a few near the vertex. Toward the top the body-whorl is rather compressed, the vertex being a *very narrowly rounded, compressed* margin around the *wide open* and deep apical umbilicus, which is closely spirally grooved within (fig. 46). Aperture narrow above, wider below; columella with a *brown-stained*, lunate, reflexed callus; parietal callus thin.

Alt. 24, diam. 13 mill.

Mediterranean Sea; Atlantic coasts of Portugal and Morocco; Pliocene of Florida (Dall), *and living at Clearwater Harbor, W. Florida* (Johnson).

Bulla striata BRUGIERE, Encycl. Méth. i, p. 572.—PHIL. Moll. Sicil. i, p. 121.—WEINKAUFF, Conchyl. Mittelm. ii, p. 191.—*B. omphalodes* MKE., Zeitschr. f. Mal. 1853, p. 137; Malak. Bl. i, p. 44.—*B. columnæ* DELLA CHIAGE, Test. utr. Sicil. iii, 2, p. 24, t. 46, f. 17, 18.—*B. dactylis* MKE, Zeitschr. f. Mal. 1853, p. 137.—*B. striata var. attenuata* DALL, Trans. Wagner Free Institute of Science of Philadelphia iii, pt. 2, p. 219, pl. 13, f. 10a.

The prominent features of this Mediterranean species are its narrow vertex, widely open apical umbilicus, and the striation of both ends of the shell. There is a variety (from Algeria, etc.) in which the umbilicus is much narrower, not striated within, and without spiral grooves at the upper end; but my material is not sufficient to show what status this form has. It may be a variety or a mere random variation. Smith has reported *striata* from St. Helena, but his synonymy is incorrect.

Specimens from the western Mediterranean are large, dilated below, with compressed outer lip and rounded basal lip; the superior striæ few or even obsolete, color as in the type, or boldly clouded with black longitudinally. Figures 42, 43 represent shells of this sort. Alt. as much as 30 mill.

I have satisfied myself by a comparison of specimens that Dall's var. *attenuata* from the Pliocene of Shell Creek, Florida, is absolutely identical with typical Mediterranean shells, such as the Grecian specimen drawn in fig. 46 of pl. 37. It is likely that in Pliocene times the species *striata* had a wide range embracing the Mediterranean, West African and Antillean regions. It has persisted almost unchanged in the former of these, and in West Africa and America has diverged to form several ill-defined species, *adansoni*, *occidentalis*, *amygdala*, etc. However, a recent specimen collected by C. W. Johnson at Clearwater Harbor, W. Florida, is indistinguishable from the Mediterranean types, having the same compressed and widely umbilicated vertex, and subtruncate columella.

B. ADANSONII Philippi. Pl. 38, fig. 61.

Shell ovate-oblong, solid; whitish variegated with gray and black, striated below. Vertex *perforated*. Aperture dilated below, narrow above, the lip depressed and rectilinear in the middle. Alt. 11, diam. 6⅓ lines. Shell smaller and more ventricose than *B. striata* of the Mediterranean, and differing in the very narrow apical

umbilicus. Smaller than *B. media*, with narrower umbilicus. (*Ph.*).

Senegambia.

B. adansonii Ph., Zeitschr. f. Mal. 1847, p. 121.—A. Ad., Thes. p. 576, pl. 123, f. 13.—Sowb., Conch. Icon., f. 13.—Dautz., Mem. Zool. Soc. France, iv, p. 25, 1891.—*B. adansonii? var. minor* Dkr., Ind. Moll. Guin. Infer. p. 4, pl. 4, f. 11, 12.

Some specimens I have seen of this species differ from *B. striata* in the points mentioned by Philippi. The figure on pl. 38 is copied from Reeve, and is larger than the shells before me. Dunker has given two figures of a var. *minor*. See pl. 39, f. 74, 75.

Specimens referable to *B. adansoni* are also before me from Corisco, W. Africa. They constantly possess basal grooves, but there are none at the vertex. The apical umbilicus is nearly as wide and open as in typical *B. striata*. The color-pattern is a close, even speckling of white dots, each with a dark brown or blackish dot at its left side, and there are two or three dark girdles. Alt. 24, diam. 13 mill. One of these is shown in pl. 48, fig. 21.

It is indeed difficult to distinguish some West African specimens from the Antillean *B. amygdala;* but as the geographic ranges of the two are now so widely sundered, I consider it best to make the distinction between them here. The only alternative to this course would be to "lump" the whole *striata* group. Perhaps malacologists may eventually rank the various forms of this group as "subspecies" or geographic varieties; and this would be by no means an unphilosophical procedure.

Var. compressa Rochebrune. Pl. 39, figs. 66, 67.

Shell distorted elongate, thick, longitudinally intensely striated, concentrically, very minutely lirate at the anterior margin, liræ distant; vertex obtuse, profoundly umbilicate. Aperture subample, pyriform, narrow in front, dilated behind [sic]; lip equalling the spire; flattened in the middle, thickened and recurved below; columella arcuate thickened.

Alt. 17, diam. 10 mill. (*Rochebr.*).

Fossil in the conglomerates of Santiago, Cape Verdes.

B. compressa Rochebr., Nouv. Arch. du Mus. (2), iv, p. 265, pl. 18, f. 10.

Closely allied to *B. adansonii* and var. *minor* Dkr.

(*Group of B. solida*).

B. PERDICINA Menke. *Unfigured.*

Shell elliptical-ovate, somewhat narrowed below, narrowly umbilicated above, solid, opaque, nearly smooth, the longitudinal striæ scarcely seen, spiral striæ wanting; lip subarcuate, with obtuse margin. Bright rufous-reddish, everywhere with whitish blotches and brown dots articulated and somewhat banded.

Alt. 10, diam. 6·5 lines. (*Mke.*).

Guinea; Sierra Leone; Benguela.

Bulla (*Bullea*) *perdicina* MKE., Mal. Bl. 1853, p. 140.—DKR., Ind. Moll. Guin. Inf., p. 5.

The quite egg-shaped form, solidity, opaqueness, smoothness and light coloring of the shell, distinguish this species from others. (*Mke.*).

B. SOLIDA Gmel. Pl. 43, figs. 1, 2; pl. 38, fig. 54; pl. 37, figs. 36, 37, 38.

Shell oval, *solid and strong*, clouded with purple *on a diffused light ground-tint of purple and white, spotted with darker dots shading on the left side, bordered with white on the right side.* Surface smooth with *no spiral grooves* whatever, but showing under a strong lens, *very dense and minute, spiral striæ, much waved and crenulated.* Vertex rounded, with a moderate apical umbilicus, showing more or less spiral liration within. Outer lip rising but little above the vertex, its outer margin a little arcuate, base widely curved; columella arcuate, with a wide, reflexed whitish or tinted crescentic callus; parietal callus strong. Interior rather livid, the lip-edge reddish.

Alt. 35, diam. 25 mill.

Gulf of Maracaibo (Capt. A. P. Foster!); *Vera Cruz, Mexico* (Heilprin Exped., 1890!); *St. Thomas* (Krebs; Rüse); *Cuba* (Orb.); *Martinique* (Candé); *Guadeloupe* (Hotess.).

Bulla solida GMEL., Syst. Nat. (13), p. 3434, founded upon the *Violetfärbiges Kibitz Ey* of KNORR, Vergnügen der Augen und des Gemüths, pt. 6, p. 40, pl. 21, f. 2.—MORCH, Mal. Bl. xxii, p. 173.—*B. ampulla* ORB., Moll. Cuba, p. 121; not of Linné.

This is very distinct from other West Indian species in its solidity, rounded contour, entire lack of spiral grooves at base or top, etc. The identification of Gmelin's very inaccurate description is

not unquestionable, but is likely. Some specimens before me agree very well with Knorr's figure. On pl. 43 , figs. 1, 2, I have illustrated what I take to be a typical specimen from the Gulf of Maracaibo. Fig. 54 of pl. 38 is also typical, but worn, from Vera Cruz. Figs. 36–38 of pl. 37 represent a large individual with the outer whitish coat worn off, showing the brown under-color; for the *purple* tint of unrubbed specimens seems to be the effect of a milky film laid *over* brown markings, just as we find it in many bird's eggs.

B. ROPERIANA Pilsbry, n. sp. Pl. 48, figs. 19, 20.

Shell oval, similar in contour and general appearance to *B. solida* Gmel., but smaller, thinner, with the internal columellar ledge of callus more developed.

Color purplish, irregularly and copiously sprinkled with whitish dots, sometimes coalesing into short zigzags, each shaded on the left side with slaty- or purplish-black. Surface polished, with no spiral grooves at base or vertex, but showing under a strong lens an excessively fine (in places vanishing) spiral striation—far more minute and indistinct than in *B. solida*. Apical umbilicus moderate, about as in *B. solida*, with 7–9 spiral grooves on the last whorl within. (In *B. solida* they are fewer and more spaced, sometimes obsolete). Outer lip evenly arcuate; columella arcuate, with a reflexed crescentic callus the outer edge of which is lead-brown; inner edge thickened below by a ledge of callus somewhat as in the typical *B. striata*. Parietal callus thin, extending far out of aperture, and downward to the middle of the columellar crescent, the outer edge of which is elevated below the junction of the appressed parietal film; no umbilical chink. Alt. 22, diam. 15 mill.; a smaller specimen measures, Alt. 20, diam. 14 mill.

Balearic Is.

Several specimens occurred among *B. striata* of the form shown in figs. 42, 43 of pl. 37, communicated to me by Mr. E. W. Roper of Revere, Mass. Its only ally in the Atlantic seems to be the West Indian *B. solida*. *B. perdicina* Mke., which I have not seen, is a much narrower species; Menke's measurements being (in millimeters) about 20 by 11 mill.

(*Deep sea species, white or without mottled color-pattern.*)

B. GUERNEI Dautzenberg. Pl. 39, figs. 68, 69 70.

Shell 3 mill. high, 2 mill. wide; convolute, solid, ovate-globose. First whorl almost wholly concealed; last whorl very narrowly per-

forated or false-umbilicate above, rimate beneath; smooth, shining, showing when strongly magnified, numerous very weak growth-striæ; toward the base there are some well-marked, spaced spiral striæ. Aperture kidney-shaped, as long as the shell; columella thick, arcuate, a little reflexed; lip acute and arcuate; color subhyaline white. (*Dautz.*).

Pico, Azores, 1287 meters.

Bulla guernei DAUTZ., Rés. Camp. Sci. Albert I, fasc. i, Contr Fauna Malac. des Iles Açores, p. 24, pl. 1, f. 5*ad.*, 1889.

B. SEMILÆVIS (Jeffr.) Seguenza.

I have not access to the work containing a description and figure of this species.

Bay of Biscay (Jeffr.); *West of Azores*, 1000 fms.; *off Fayal, Azores* 450 fms., *and off San Miguel, Azores*, 1000 fms. (Chall.); *Middle Pliocene of Calabria* (Seguenza).

Bulla semilævis JEFFREYS, Rep. Brit. Asso. Adv. Sci. 1880, p. 10, name only.—SEGUENZA, Form. Terz. Calabria, in Mem. Acad. di Lincei, Ser. 3, vi, p. 251, pl. xvi, f. 5.—WATSON, Challenger Gastr., p. 638.

BULLA SUBROTUNDA Jeffreys (Rep. Brit. Asso. Adv. Sci. 1873, p. 113, name only. Monts., Bull. Soc. Mal. Ital. vi, p. 77). Off Jijeli, Algerian coast of Mediterranean; also Atlantic, and fossil at Ficarazzi.

B. KREBSII Dall. *Unfigured.*

Shell nearly the form of *B. occidentalis* A. Adams, but more cylindrical and of an ivory porcellanous white. The posterior angle of the aperture is more sharp and the aperture near it narrower, while on the columella there is a faint revolving ridge which suggests a plait, though too obscure to be so named. The surface is brilliantly polished, with perceptible incremental lines. Callus on the body thin, with a very minute chink behind that on the pillar. Apex deeply sunken, pervious, scalate, showing nearly four volutions, the margin of the vertex rounded, with faint indications of a carinal line. Max. lon. 8·0; max. lat. 5·0 mill. (*Dall*).

Near Guadeloupe, in 769 fms., *East from Tobago*, 880 fms.

Bulla krebsii DALL, Blake Gastr., p. 56; Proc. U. S. Nat. Mus. xii, 1889, p. 298.

I cannot make this fit in with any previously known species. It may prove not to be a typical Bulla. (*Dall*).

B. CLAUSA Dall. *Unfigured.*

Shell small, subtranslucent, solid, of the form of *B. solida* (Gmelin, non Brugière) pale yellowish-brown verging towards salmon color in the darkest parts; surface polished, with well marked incremental lines and extremely fine microscopic wavy spiral striæ over the whole surface. Aperture as long as the shell; wide anteriorly with a strongly arched callus, white columella having a groove behind it and a thin callus on the body. Apex impeforate, meeting the descendiug outer lip with hardly a dimple. Max. lon. 11·5; Max. lat. 7·75 mill. (*Dall*).

Bulla clausa DALL, Blake Gastr., p. 57.

Florida, collector unknown, U. S. Nat. Museum, No. 55188.

This is the only shell, except the abyssal species like eburnea and abyssicola, having the solidity and characteristic form of typical *Bulla*, which I have found without an apical perforation or distinct pattern of coloration, yet it seems too heavy and porcellanous to be referred to *Haminea*. It was probably collected by Stimpson. (*Dall*).

B. ABYSSICOLA Dall. Pl. 36, fig. 31.

Shell of moderate size, and nearly the shape of *B. ampulla*, but proportionately wider behind, white with an ill-defined band of pale yellow-brown encircling the periphery; aperture as long as the shell; outer lip simple, nearly straight, rounded before and behind, not extending beyond the summit of the left side of the shell; apex depressed, immersed, forming a slight pit with none of the whorls visible; surface ornamented with fine, minutely punctate spiral grooves, more crowded before and behind, more distant about the periphery, from four to twelve in the width of a millimeter and from eight to ten punctations in the length of a millimeter, according to the part of the shell examined, besides these there are numerous still finer striæ, also punctate, but more finely, which, when very faint, appear like rows of very faint puncticulations; otherwise the surface is smooth, or even polished, the lines of growth hardly perceptible; aperture narrow behind, wide in front, the pillar reflected, and a thin layer of callus evenly spread over the body within the aperture; proportions of younger specimens much the same, but a

little more pointed at the extremities. Lon. of shell and aperture, 12·75. Max. lat. of shell, 9·0; of aperture, 5·25; min. lat. of aperture, 1·5 mill. (*Dall*).

Yucatan Strait, 640 fms.; *off Frederikstadt, Santa Cruz*, 508 fms. (Blake); *Bay of Biscay* (Travailleur); *off Fayal, Azores* 450 fms. (Chall.).

Bulla abyssicola DALL, Bull. M. C. Z. ix, p. 97; Blake Gastr., p. 56, pl. 17, f. 11.—*B. pinguicula* JEFFR., Ann. Mag. Nat. Hist. (5), vi, p. 318 (name only).—WATSON Chall. Gastr. p. 638.

The nearest relative of this species appears to be the *Bulla utriculus* of Europe, which is longer, less cylindrical, and has a deep pit at the apex. I have been enabled from an inspection of his type to determine that the manuscript name of Dr. Jeffreys applies to this species. (*Dall*).

B. GEMMA Verrill. *Unfigured.*

Shell white, rather solid, resembling, in size and form, *Cylichna occulta* (Migh.), but distinguished by having a small, distinct umbilicus, and also a narrow deep pit at the apex of the spire. Sculpture, a few distinct spiral lines at each end; middle region of shell smooth. Length, 4·2; breadth, 2·5 mill. (*V.*).

Outer banks, off Southern New England (*U. S. Fish Com. stations* 871, 873).

Diaphana (*Utriculus*) *gemma* V., Amer. Journ. Sci. (3), xx, p. 399 (1880).

Dall believe this to be the same as his later described *B. eburnea.*

B. EBURNEA Dall. Pl. 36, fig. 21.

Shell small, ivory-white, polished, ovate, the aperture extended posteriorly a little beyond the left hand summit of the whorl; sculpture, a few spiral grooves near either extremity, more numerous and crowded anteriorly; these grooves somewhat zigzag from irregularities of growth, but not puncticulate; remainder of the shell without sculpture, except most minute microscopic faint indications of spiral striæ and faint lines of growth; apex minutely pitted, but the pit nearly covered by a small reflection of the lip where it joins the posterior face of the body; outer lip thin, sharp, curved round and reflected at the anterior end of the axis; a thin deposit over the

body within the aperture. Lon. of shell and aperture, 7·25. Max. lat. of shell, 4·25; of aperture, 2·0; mill. lat. of aperture, 0·75 mill. (*Dall*).

Blake Station 43, 339 fms.

Bulla ? eburnea DALL, Bull. M. C. Z. ix, p. 98, 1881; Blake Rep. p. 55, pl. 17, f. 6.—? *Diaphana gemma* VERRILL Amer. Journ. Sci. (3) xx, p. 399.

I have seen only one specimen of each of the above species, and they certainly appear very different in some respects; but the range of variation in these forms is little understood, and I do not feel confident that it may not be larger than generally supposed. In that case it is possible that the two forms may represent the extremes of one species. This should not be confounded with the *Bulla eburnea* of A. Adams, which is a member of the genus *Volvula*. Not possessing the soft parts, I have preferred to refer this species to the genus *Bulla*, though it may belong in the preceding family. (*Dall*).

SPECIES OF THE WEST COAST OF AMERICA.

B. GOULDIANA Pilsbry. Pl. 36, figs. 22, 23, 24.

Shell large, ovate or oval, *thin;* pinkish fawn-colored *dappled with slate-black spots, each shading into the ground-color on the right and bordered with whitish on the left, or with similarly shaded* ≽*-shaped or* ≻*-shaped markings;* covered when fresh by a yellowish-brown or mahogony epidermis. Surface smoothish, with irregular growth-wrinkles; showing under a strong lens *an extremely minute granulation.* Apex narrowly umbilicated, the interior of the perforation showing no spiral striæ, or but a few in its depth. Columella thickened with a crescentic callus. *Interior of mouth showing the external markings* viewed by reflected light.

Alt. 55, diam. 37 mill.

Alt. 40, diam. 30 mill.

San Pedro, Santa Barbara and San Diego, California, to Cape St. Lucas; Guaymas, West Mexico and Mazatlan.

Bulla nebulosa Gould, A. AD., Thes. Conch. ii, p. 578, pl. 123, f. 79, 80.—MKE., Zeitschr. f. Mal. 1850, p. 162.—CARPENTER, Moll. Western N. A, pp. 22, 26, 79, 85, 107, 132, 151, 153; Rep. Brit. Asso. Adv. Sci. 1856, pp. 198, 233, 234, 237, 284, 289, 313, 352, 353; Mazatlan Catal., p. 173, 540; P. Z. S. 1856, p. 220.—SOWB.,

Conch. Icon. xvi, f. 6.—KEEP, West Coast Shells, p. 126, f. 117. Not *B. nebulosa* Schroeter, 1804.

This large species is much thinner than *B. ampulla*. It is larger than any other American form, and has a characteristic pattern of coloration and microscopic sculpture.

B. ASPERSA A. Adams. Pl. 37, figs. 25, 26, 27, 28.

Shell oblong-ovate, narrowed anteriorly, solid, opaque, longitudinally substriated, with numerous very fine striæ, painted with white punctured spots; outer lip rather straight, its upper angle produced; inner lip thickened, white internally. (*Ad.*).

Payta, Peru, 6–8 fms. (Cuming).

B. aspersa AD., Thes. p. 578, pl. 123, f. 78.—SOWB., Conch. Icon., f. 18.

This species is evidently closely allied to *B. punctulata*, but the exact relationship of the two can be settled only by an examination of the type specimen. Figs. 27, 28 represent a lower Californian shell referred to this species, but not without some doubt. It differs from *punctulata* in having the interior of the apical umbilicus sculptured with fewer (3–5) widely spaced spiral impressed striæ.

B. PUNCTULATA A. Adams. Pl. 37, fig. 39; pl. 36, figs. 29, 30.

Shell oval, solid; indistinctly clouded with flesh-color on a lighter ground, and usually obscurely blotched with dark, forming two ill-defined girdles; the whole showing few or *many dark dots shaded on the left, white-edged on the right side.* Surface smooth, showing under a strong lens *an excessively close and fine wavy spiral striation.* Vertex umbilicated, *the interior of the umbilicus sculptured with deep spiral grooves,* about a dozen in number. Aperture lined with whitish, scarcely showing the external markings. Columella bearing a heavy lunate callus which is often brown-edged; parietal callus thick and heavy.

Alt. 25, diam. 16 mill.

Panama (Cuming); *Mazatlan; Cape St. Lucas.*

Bulla punctata A. AD., Thes. Conch. ii, p. 577, pl. 123, f. 77. Not of Schroeter.—*B. punctulata* A. AD., *t. c.*, p. 604.—SOWERBY, Conch. Icon. f. 8.—*Bulla adamsi* Mke., CPR., Maz. Catal., p. 172 (and perhaps *B. adamsi* Mke., Zeitschr. f. Mal. 1850, p. 162, excl. synonymy). —? *B. quoyi* A. AD., Thes., p. 576, pl. 123, f. 71, and SOWB., Conch. Icon. f. 19.

This species may prove the same as the earlier described *B. rufolabris*. It is smaller and much solider than *B. nebulosa*, with the apical umbilicus wider and strongly grooved spirally within. The external sculpture of close microscopic wavy striæ is also characteristic.

It is not perfectly clear what Menke intended to indicate by his *B. adamsi*. He expressly states that it has no spiral striation, and he says that it is the *B. australis* of Adams (see pl. 35, figs. 15, 16, copies of Adams' figures), not *australis* Quoy. Now Adams' figures show none of the dark and white dotting so characteristic of this west coast species, and are certainly different; and as Menke's description certainly does not apply well to the species under consideration, the name *adamsi* has better be dropped from the list of West American Bullas.

Angas reports *B. punctulata* from Port Jackson and New Caledonia (P. Z. S. 1867, p. 226). A tray of Australian specimens before me, sent by Dr. J. C. Cox, show no variation whatever from the many specimens before me from Panama, Mazatlan and Cape St. Lucas.

B. punctata (A. Ad. MS.) Sowerby (Conch. Icon. f. 15) seems to me only a large form of *B. punctulata*. In any case the name cannot be used, being preoccupied. Sowerby's figures are copied on pl. 37, figs. 40, 41, and his description is as follows: Shell ovate-ventricose, solid, smooth, slightly narrowed posteriorly, reddish-grey, clouded with brown, sprinkled with small spots, posterior end obtuse, sides rather compressed, umbilicus large, columella thick, rather straight, outer lip thinly expanded. While the form is like that of *Bulla cruentata*, the markings of this shell resemble those of *B. aspersa*, which is more tapering towards the upper end. (*Sowb.*).

Bulla quoyi of A. Adams (pl. 34, fig. 9) is probably a synonym of *B. punctulata* or *B. aspersa*. At all events, it is certainly not the true *quoyi* of Gray.

B. RUFOLABRIS A. Adams. Pl. 37, figs. 47, 48.

Shell elongately cylindrical, solid, opaque, longitudinally grooved; reddish, painted with dark ash-colored spots, dotted with white; lip rather straight, bent in in the middle, the margin of a red color. (*Ad.*).

Galapagos Is., 6 fms. (Cuming).

Bulla rufolabris Ad., Thes. ii, p. 577, pl. 123, f. 76.—Sowb., Conch. Icon. f. 17.

I have not seen this species, which seems to be distinguished from *B. punctulata* mainly by its red-edged lip.

B. panamensis Philippi. *Unfigured.*

Shell oblong-ovate, solid; whitish marbled with brown; *destitute of transverse striæ;* vertex umbilicated, spirally striated; aperture dilated below, narrow above; lip straight in the middle.

Alt. 11, diam. 8 lines. (*Phil.*).

Panama (E. B. Phil.).

B. panamensis Ph., Zeitschr. f. Malak. 1848, p. 141.

Distinguished from *B. media* and *B. striata* by the lack of all striæ (*Ph.*). This is probably identical with *punctulata* or *aspera*, but the description is not sufficient for identification.

B. exarata Carpenter. *Unfigured.*

Shell small, elliptical, compressed, aperture elongated, narrow; brown, covered with a thin epidermis; spirally delicately grooved, the lines more or less distant, nearly vanishing in the middle; spire hardly deeply umbilicated, with transverse divaricate striæ within; lip produced above; inner lip forming an umbilicus-like chink toward the columella.

Alt. ·125, diam. ·055 inch. (*Cpr.*).

Mazatlan, on Spondylus, Liverpool Coll.

Bulla exarata Cpr., Maz. Cat., p. 173.

Distinguished by the acuminated form, fine, rather distant spiral grooves, narrow produced aperture, and slight umbilical chink formed by a fold of the labium. The small spiral umbilicus appears slightly denticulate within, from the striæ of growth being there well marked. The labrum extends ·005 beyond the spire. (*Cpr.*).

Indo-Pacific Species.

B. ampulla Linné. Pl. 34, figs. 1, 2, 3.

Shell large, *solid, globular-oval,* with the lateral outlines everywhere well rounded. *Closely and finely mottled or speckled all over* with pinkish-gray on a creamy or flesh-tinted ground, usually with darker clouds, irregular or ⋗-shaped; covered when fresh with a

thin yellowish-brown epidermis. *Surface smooth*, showing under a lens neither spiral striæ nor granulation. Apical umbilicus very small and deep, without spiral striæ within when adult. Aperture narrow and curved above, dilated below, lined with white callus; columella heavy and thick, with a crescentic white callus; parietal callus strong.

Alt. 51, diam. 39 mill.

Viti Is. (Garrett); *Fiji Is.* (U. S. Expl. Exped.); *Lombok* (Tudor); *Philippines* (Ad.); *Port Jackson* (Challenger); *Port Stephens and Bellenger River* (Brazier); *Red Sea* (Issel); *Seychelles, Amirantes, Madagascar, Mauritius, Réunion,* (Martens); *Natal Bay* (Krauss).

Bulla ampulla L., Syst. Nat. xii, p. 1183.—Sowerby, Genera, pl. 31, f. 4.—Ad., Thes. Conch. ii, p. 575, pl. 122, f. 59–62.—Sowb., Conch. Icon., f. 3.—Issel, Mal. Mar Rosso, p. 167, 281.—Martens, Meeresfauna Mauritius, p. 303; Monatsber. Berl. Acad. 1879, p. 737.—Cooke, Ann. Mag. N. H. (5), xvii, p. 130.—Watson, Challenger Gastr. p. 637.—Krauss, Die Südafrik. Moll. p. 70.—Angas, P. Z. S. 1877, p. 189.—*B. villosa* Martyn, Univ. Conch. ii, pl. 95; Chenu's edit. p. 26, pl. 32, f. 3a.

The largest species of the genus. It is distinguished from *nebulosa* by the greater solidity and the coloration, which never shows dark shaded spots edged with white on the right side. It is more globose than *B. australis* or *B. adamsi*.

Var. *bifasciata* Menke. Pl. 34, fig. 5.

Shell smaller, mottled all over as in the type, but encircled by two dark bands; columella often with a low projection.

Fiji Is.; Moluccas; Philippines.

Bulla collumellaris var. bifasciata Mke., Mal. Bl. i, p. 43, founded upon Martini Conch. Cab. vol. i, f. 190, 191.—*B. bifasciata* Gould, U. S. Expl. Exped. Moll., p. 220, f. 264, 1852, (as of Martini and Chemnitz).

Var. *trifasciata* Sowb. Pl. 34, fig. 4.

Shell mottled and encircled by three dark bands. Hardly distinct varietally from the preceding.

Philippines (Cuming); *Hall Sound, New Guinea; Solomon Is.* (Brazier).

B. trifasciata Sowb., Conch. Icon., f. 1, March, 1868.—Brazier, P. L. S. N. S. W. ii, p. 83.

Menke attempted to separate from *B. ampulla* certain forms under the name *B. columellaris* (Mal. Bl. 1854, p. 26); these shells, he claims, are mostly smaller than *ampulla*, thinner, more translucent, with narrower apical perforation; the upper process of the lip is broadly rounded "like the wings of a brooding hen;" the columella is flattened, and has a low projection. In the suite before me I am unable to make the separation he indicates, as the characters seem to be too variable, and those he mentions are not always correlated with each other.

B. cruentata A. Adams. Pl. 34, figs. 6, 7.

Shell ovately-globose, inflated, solid, opaque; variegated with blood-red spots, punctated with white; white within. (*Ad.*). Shell ovate-subpyriform, narrowed above the center, solid, smooth, red, variegated with large red-brown patches and blackish spots; aperture large, pale reddish, expanded at the lower part; outer lip rose colored, raised above the apex, rounded; inner lip white, thickened; columella thick, broad, arched; apical umbilicus rather wide. (*Sowb.*).

Réunion (Desh.); *Moluccas* (Cuming).

B. cruentata Ad., Thes. p. 577, pl. 126, f. 75.—Sowb., Conch. Icon., f. 2.—Probably *Bulla rubicunda* Schroeter, Archiv für Zoologie u. Zootomie (Wiedemann's) iv, pt. 1, p. 18 (*Conf.* Mal. Bl. i, p. 43, and Meeresfauna Maurit., etc., p. 303).

Besides the difference in general coloring and the rose bordering of the outer lip, there is a difference in shape between this species and *Bulla ampulla*, the former being more compressed above the center. (Sowb.).

B. adamsi Menke. Pl. 35, figs. 15, 16, 19, 20.

Shell oval-*cylindric*, solid, closely marbled with reddish on a pale ground, much as in *B. ampulla; generally having three or four bands of darker mottling.* Vertex umbilicated, the umbilicus not spirally striated within in adults. Outer lip nearly straight in the middle; columella and parietal wall strongly calloused. Alt. 45, diam. 30 mill.

Tahiti (Cuming); *Tonga* (Phila. Acad. Coll.); *Islands in Torres Straits and off N. E. Australia* (Brazier).

Bulla adamsii MENKE, Zeitschr. f. Mal., 1850, p. 162; Mal. Bl. 1854, p. 43.—*B. adamsi* BRAZIER (again), Proc. Linn. Soc. N. S. Wales, x, p. 92, 1885.—*B. australis* A. ADAMS, Thes. ii, p. 576, pl. 122, f. 64–66.—SOWB., Conch. Icon., f. 12.—WATSON (in part) Challenger Gastr., p. 638. Not *B. australis* Gray nor Sowerby.

A more cylindrical, less inflated shell than *B. ampulla*, and wider than *B. australis*, with wider umbilicus. In his attempt to rectify the error of Adams, Mr. Brazier added another synonym to this species; but the name he gives had been anticipated by Menke, thirty-five years previously.

B. AUSTRALIS (Gray) Quoy & Gaimard. Pl. 35, figs. 17, 18.

Shell elongated, cylindrical; color variable, but usually pale, marbled with reddish, with longitudinal deep brown flames, sometimes traversed by a narrow, well defined band. Aperture rising above the spire, enlarged toward the base; vertex impressed and perforated by a very small apical umbilicus.

King George's Sound (Q. & G.); *between Freemantle and Woodmans Point, W. Australia* (Menke); also *Tasmania* (Beddome et al); *Port Jackson* (Brazier); *Spencer and St. Vincent Gulfs* (Angas); *Port Lincoln and Adelaide; New Zealand* (Yates and Dieffenbach).

B. australis GRAY, Annals of Philos. (n. s.) ix, p. 408, 1825; Capt. King's Surv. Intertrop. Austr. ii, appendix, p. 490, 1827.—BRAZIER, Proc. Linn. Soc. N. S. Wales, x, p. 89, 1885.—*B. australis* Q. & G. (*de novo*), Zool. Voy. de l'Astrol. ii, p. 357, pl. 26, f. 38, 39. Not *B. australis* A. Ad. or Sowerby.—*Bulla oblonga* A. AD., Thes. ii, p. 577, pl. 123, f. 74.—SOWB., in Conch. Icon., f. 9.—? *B. substriata* MKE., Zeitschr. f. Mal., 1853, p. 136.

The typical *australis* is elongated with the apical perforation minute or closed. This form may be confined to the western and southwestern coasts of Australia. Gray's several descriptive notices of the species are wretchedly inadequate, and I have therefore left Quoy & Gaimard's names stand for it. Brazier has given the synonymy almost in full. The distribution of this species in New Zealand requires confirmation and comparison with Australian specimens.

Var. OBLONGA A. Adams. Pl. 35, figs. 12, 13, 14.

Shell oblong, a little narrower above, the side outlines slightly convex. Surface polished, showing when strongly magnified *very*

close, fine, crenulated spiral striæ. Apical umbilicus about 2 mill. wide, not spirally grooved within; lip thin at its origin on the vertex, curving strongly forward above, straightened in the middle; columella short, concave, the edge of the reflexed crescentic callus appressed; parietal callus light. Alt. 53, diam. 30 mill.

Philippines and Island of Annaa, on the reefs (Cuming); *Port Jackson.*

This variety seems to be less narrow than the type, and the umbilicus is wider. The specimen described above is from Port Jackson, collected by Godeffroy.

A. ANGASI Pilsbry. Pl. 36, figs. 32, 33.

Shell thick, subcylindrical, rather short, posteriorly subattenuated, anteriorly rounded, smooth, whitish, variegated and clouded with red band and broad spots, with white angular lines; aperture white, outer lip thickened within, inner lip strongly arched. (*Sowb.*)

Middle Harbor, Port Jackson (Angas).

B. solida A. Ad. MS., SOWB., Conch. Icon., f. 10.—*B. solida* Gmel. MS. ANGAS, P. Z. S., 1867, p. 226. Not *B. solida* Gmelin.

Among the many *B. solida* before me, none show any approach to the style of painting of this species, which I know only from the works of Sowerby and Angas. The latter author says: a prettily painted species, peculiarly marked with large angular blotches of rose liver-color on a grayish-white ground. Length 1 inch.

B. TENUISSIMA Sowerby. Pl. 34, figs. 10, 11.

Shell ovate-oblong, subcylindrical, subpellucid, very thin, pale brown, variegated with subquadrate, dull brown spots, principally arranged in four rows, umbilicus wide, margin of the aperture rather straight, columella margin white, flat, arched, narrow. (*Sowb.*).

Swan River, Australia.

B. tenuissima SOWB., Conch. Icon., f. 4, Jan., 1868.

Remarkable for the thinness of its half-transparent texture. (*Sowb.*).

B. INCOMMODA Smith. Pl. 39, fig. 72.

Shell small, narrowly umbilicated, ovate, white, shining, sculptured above and below with few transverse striæ, striated with lines of growth; apex very narrowly perforated. Aperture narrow, a little dilated beneath, produced above the vertex above; columella

slightly twisted, arcuate below, reflexed, expanded. Alt. 5⅛, greater diam. 3½, lesser diam. 3 mill. (*S.*).

Off Sydney; S. Lat. 34° 13′, *E. Long.* 151° 38′ (Challenger).

Bulla incommoda E. A. Smith, P. Z. S., 1891, p. 442, pl. 35, f. 20.

The few spiral striæ at each end are rather far apart with the exception of those immediately around the umbilicus, which are more approximated. (*S.*).

B. quoyi Gray. Pl. 39, fig. 71.

Shell oval, solid, indistinctly and closely marbled with fleshy purple gray on a pale ground, with two or three ill-defined encircling zones of heavier, darker mottling. *Surface smooth, but sculptured toward the base by separated spiral grooves,* becoming closer below; apical perforation moderately wide, either spirally grooved within or nearly smooth. Columella with a moderate, lunate white callus; parietal callus thin. Interior whitish or fleshy. Alt. 25–26, diam. 16 mill.

Bay of Islands (Quoy); *Auckland* (Hutton; Wright).

Bulla striata Q. & G., Voy. de l'Astrol., Zool. i, p. 354, pl. 26, f. 8, 9. Not of Linné.—*B. quoyii* Gray, Dieffenbach's N. Z. ii, p. 243.—Smith, Zool. Erebus & Terror, p. 5, pl. 1, f. 11.—Hutton, Man. N. Z. Moll., p. 121. Not *B. quoyi* A. Ad., Sowb. or Cpr.

Well distinguished from other species of the southwest Pacific by the spiral grooves at the base.

B. peasiana Pilsbry, n. n. Pl. 34, fig. 8.

Shell ovately-oblong, thin, light, perforate; outer lip straight; longitudinally finely striated, and marked with fine microscopic spiral striæ. Color chocolate-brown, mottled with darker, and freckled and blotched with white. (*Pse.*).

Sandwich Islands (Pse.).

Bulla marmorea Pse., P. Z. S., 1860, p. 431.—Sowb., Conch. Icon., f. 16. Not *B. marmorea* Schroeter.

The specimens before me are excessively similar to the West Indian *B. occidentalis;* in fact would be considered that were it not for the difference in locality. Can the Sandwich Islands specimens be ballast shells? The name of the species is preoccupied by Schroeter.

B. CONSPERSA Pease. Pl. 39, fig. 73.

Shell ovate, rather solid, perforate, smooth, marked faintly with longitudinal striæ of growth ; aperture contracted above, expanded below ; outer lip slightly produced posteriorly ; white, promiscuously spotted and mottled with white, black and brown of different shades, towards the base encircled with a single red band which is generally obsolete or altogether wanting. (*Pse.*).

Marquesas Is.

B. conspersa PSE., Amer. Journ. Conch., v, p. 72, pl. 8, f. 9. 1869.

Compare *B. ovula* Gld. with which this may prove identical.

B. VERNICOSA Gould. *Unfigured.*

Shell ovate-globose, solid, smooth, widely perforated ; ashy, variegated with rufous, and encircled by four bands of brown spots sometimes angular. Aperture narrow, lip straight, slightly inflected, rufous-edged ; throat porcellaneous. Alt. 1·3 in., diam. ·8 in. (*Gld.*).

Liu Kiu Is. (W. Stimp.).

B. vernicosa GLD., Proc. Bost. Soc. N. H., vii, p. 138, Oct., 1859; Otia Conch., p. 111.

Very shining, less inflated and narrower aperture than *B. ampulla ;* more globose and more polished than *B. australis* (*Gld.*).

The following seems to be a synonym or variety of *vernicosa.*

VAR. OVULA (Gld.) Sowb. Pl. 36, figs. 34, 35.

Shell oblong but with convex, not flattened lateral outlines; slightly narrowed above; apical umbilicus narrow (1 to 1½ mill. diam.), white and weakly spirally grooved within. Brown with scattered white dots, and showing three or four spiral ill-defined bands of darker clouding or mottling. Columella rather straightened, with a chink along the edge of the reflexed crescentic white callus.

Alt. 24, diam. 16 mill.

Alt. 21, diam. 13½ mill.

Boshiu, Japan ; Liu Kiu Is. (Fr. Stearns).

B. ovula (Gould, where?) SOWB., Conch. Icon., f. 5, Jan., 1868.

Evidently nearly allied to *B. conspersa* Pse. Perhaps this is the shell Dunker called "*B. ampulla.*" Angas (P. Z. S., 1867, p. 227) has quoted "*B. ovulum* Gld. MSS. in Mus. Cuming" as a synonym

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of his *B. magdelus* Lister, from Middle Harbor and Long Bay, N. S. Wales. The name "*magdelus*" seems to be an odd error for *amygdalus* (Lister, pl. 714, f. 72), a West Indian form.

* * * * * * * * *

The following species described by Schroeter are in my opinion not identifiable with certainty unless the types can be found. All but the latter three or four are undoubted typical *Bullas*. The localities of none of them are known.

B. MAPPA Schroeter, Archiv für Zool. u. Zoot. (Wiedemann) iv, p. 17, 1804, *may* be *B. oblonga* Ad. or *solida* Gmel. The coloring is hardly that of *ampulla*.

B. ADSPERSA Schroeter, *t. c.* p. 18, may be *B. aspersa* Ad., *B. solida* Gmel., or some other white-sprinkled form.

B. CINEREA Schroeter, *t. c.* p. 18, may be *amygdala* Dillw.

B. TIGRIS Schroeter, *t. c.* p. 19. Undetermined.

B. RUFESCENS Schroeter, *t. c.* p. 19. Undetermined.

B. DISCORS Schroeter, *t. c.* p. 19. Undetermined.

B. NEBULOSA Schroeter, *t. c.* p. 20, may be *B. australis*.

B. MARMOREA Schroeter, *t. c.* p. 20, may be *B. adamsi*.

B. PENNATA Schroeter, *t. c.* p. 21. Undetermined.

B. PULVERULENTA Schroeter, *t. c.* p. 21. Undetermined.

B. LIGATA Schroeter, *t. c.* p. 21. Undetermined.

B. ANNULATA Schroeter, *t. c.* p. 23. Undetermined.

B. PUNCTATA Schroeter, *t. c.* p. 24. Undetermined.

B. PURPUREA Schroeter, *t. c.* p. 24, =*Achatina purpurea* Gmel.

BULLA (BULLEA) CYPRAEOLA Menke, Zeitschr. f. Mal., 1853, p. 140, habitat unknown.

BULLA (BULLEA) NUX Mke., *t. c.* p. 140, from Cuba, may prove to be either *B. occidentalis* or *B. amygdala*.

BULLA (BULLEA) SPLENDENS Mke., *t. c.* p. 137, habitat unknown.

Family AKERIDÆ Pilsbry.

=*Bullidæ* in part, of FISCHER, Man. de Conch., p. 558.

Shell oval or cylindrical, *thin* and fragile, of a light yellow, brown or green tint, the spire low or concealed.

Radula having many longitudinal rows of teeth, the centrals narrow, hardly larger than the side teeth, with the cusp serrate; side teeth falcate with the cusp long and serrate, becoming simple on the outer teeth.

The genera here assembled agree in the common character of a light-colored, thin shell, and (as far as known) a multidentate radula with teeth of the primitive Tectibranch type found in *Aplysiidæ*, etc. When the anatomy of *Cylindrobulla* and *Volvatella* is better known, a division into two or three families may become necessary.

Synopsis of Subfamilies and Genera.

**Epipodial lobes developed, large.*

Subfamily AKERINÆ (*Aceridæ* Mazzarelli).

Shell fragile, elastic, with entirely exposed, nearly level spire, deep sutural slit and wide anal fasciole. Animal with long narrow head disk, large epipodial lobes reflexed over the shell, and many cartilaginous stomach plates.

Contains the single genus *Akera* (see pl. 42, figs. 11–18).

Subfamily HAMINEINÆ Pilsbry.

Shell brittle, with concealed spire; a posterior sinus, but no sutural slit or anal fasciole; the interior not wholly visible from base. Animal with a quadrate head disk, bilobed behind; epipodial lobes large, reflexed over the shell. Principal stomach plates three.

Contains the single genus *Haminea* (see pl. 40, 41).

* * *No epipodial lobes.*

Subfamily VOLVATELLINÆ Pilsbry.

Shell fragile and elastic, with concealed spire, and either a sutural slit or a posterior "spout"; no distinct anal fasciole; aperture very narrow above, effuse and open below, showing the whole interior from the base. Animal with a quadrate head disk, bilobed behind. No epipodial lobes. Dentition unknown.

a. Shell cylindrical, the aperture with a deep narrow slit following the suture. Genus *Cylindrobulla* (see plate 42, figs. 19, 20).

b. Shell swollen, contracted at vertex into an erect "spout"; no sutural slit. Genus *Volvatella* (see pl. 42, figs. 21–23).

Genus HAMINEA Leach, 1847.

Haminea Leach *MS.* Gray, P. Z. S., 1847, p. 161 (*H. hydatis*). A. Ad., Thes. Conch., ii, p. 557.—Sowb., Conch. Icon., xvi.—Vayssiere, Ann. Sci. Nat. Zool., ix, 1879–80, and Recherches sur les Moll. Opisthobr., 1re pt., Tectibranches, Ann. Mus. d'Hist. Nat. Marseille, Zool. ii, p. 18, 1885, (anatomy).—*Haminœa* Leach, Moll. Gt. Brit., p. 40, 1852.

Shell *thin* and rather fragile, *unicolored*, corneous, yellowish or greenish, covered with a thin cuticle, *globose*, ovate or cylindric-oval, the *spire sunken and concealed*, vertex concave, imperforate or minutely perforate; body whorl large; aperture as long as the shell, broadly rounded below, narrow above; columella simply concave, thin, its edge narrowly reflexed, showing a slight fold where it joins the body of the shell; lip retreating above, but not distinctly sinused. Type *B. hydatis* L.

Animal capable of retraction into the shell; cephalic disc large, truncated in front, strongly bilobed behind, the eyes small. Mantle rudimentary, covered by the shell. Epipodial lobes large, reflexed over and partially covering the shell. (pl. 43 fig. 6). Sole long, tapering behind; gizzard very muscular, armed within with three large corneous curved plates (pl. 48, figs. 2, 3), and three pairs of small plates. (See pl. 48, fig. 1, *H. navicula;* also figs. 9 to 13).

Radula having the formula ∞, 1, 1, 1, ∞. Central tooth small, adjacent laterals large, with a long serrate cusp; uncini many (55 in *H. navicula*) with long, simple cusps.

The shell in this genus differs from all other *Akeridæ* in being more compactly convoluted with less developed posterior sinus in the outer lip. It differs from *Bulla* in being thin, unicolored and imperforate or nearly so at vertex. The anatomical distinctions from *Bulla* are many and important; and it is not easy to see why Fischer placed *Haminea* under that group as a subgenus.

The anatomy has been studied and figured by Vayssière, and the shells have been monographed by Arthur Adams and Sowerby. A good figure of the dentition is still lacking.

No useful subdivision of the group other than a geographic one can now be made, althongh the different modes of the insertion of the outer lip at the vertex offers a good character (compare *H. navicula* with *H. elegans* Gray). The animals of the European and West Indian species seem to have a finely peppered or dotted

color-pattern, while such of the oriental forms as are known are more boldly spotted. The food of the European species is exclusively vegetable, consisting of algæ and zostera.

European species.

There are three European species of *Haminea:* H. NAVICULA, distinguished by its large size, very concave columella and spiral striation. H. HYDATIS, smaller (rarely over 12 mill. alt.) with straighter columella and more effaced spiral striation. H. ORBIGNYANA, about the size of *hydatis*, but having the upper curve of the lip prolonged high above the vertex.

H. NAVICULA Da Costa. Pl. 41, figs. 17, 18.

Shell thin, oblong-cylindric, truncated above, rounded below; surface corneous or lemon-yellow, *marked by irregular growth wrinkles*, and *showing all over under a lens, excessively fine spiral wavy engraved grooves*, far narrower than their interspaces. Vertex imperforate, concave and white in the middle. Outer lip slightly arcuate, rounded above and below, a little thickened, but not twisted toward the upper insertion. *Columella very concave*, thin, reflexed; parietal callus thin. Alt. 23, diam. 16 mill.

Atlantic coast of Europe from England to Spain; Mediterranean Sea.

Bulla ampulla PENNANT (not L.) Brit. Zool. no. 84, 1776.—*B. navicula* DA COSTA Brit. Conch., p. 28, pl. 1, f. 10, 1778.—BUQUOY, DAUTZ. & DOLLF., Moll. Rouss. i, p. 517, pl. 63, f. 4–7.—*B. hydatis* BRUG., Enc. Meth., p. 374, in part.—FORBES & HANLEY, Hist. Brit. Moll., iii, p. 530, pl. 104d, f. 7 (shell); pl. uu, f. 3 (animal).—JEFFREYS, Brit. Conch., iv, p. 437; v, pl. 95, fig. 3.—SOWB., Conch. Icon., f. 4, and of authors generally. Not *B. hydatis* Linné.—*Bulla cornea* LAM., An. s. Vert. vi, p. 36, 1822.—*Haminea cuvieri* LEACH, Syn. Moll. G. B., p. 41, 1852.—*Haminea subpellucida* H. AD., P. Z. S. 1869, p. 275, pl. 19, f. 13.

This species is generally known as *H. hydatis*, but it is quite distinct from that species in the larger size, much stronger spiral striation, more marked growth wrinkles, more concave columella, etc. The bibliography of the form is extensive, as usual with European species, but is mostly under the names *hydatis* L. and *cornea* Lmk.

Var. *globosa* Jeffr. (pl. 41, fig. 17). More globular. Var. *globoso major* Monts. Large and globose. Venice. Var. *expansa* Monts.

Aperture much dilated. Var. *subquadrata* Monts. Subangular above and below. Var. *albina* Monts. Entirely white. Var. *ferruginosa* Monts. Ferruginous tawny. Var. *glaucescens* Monts. Pale yellow or greenish.

H. HYDATIS Linné. Pl. 41, figs. 19, 20.

Shell thin, subpellucid, oblong-oval, truncated above, rounded below; surface clear corneous or pale greenish-yellow, with slight growth lines and extremely minute close wavy spiral striæ. Vertex imperforate, narrowly concave; outer lip arcuate, rounded above and below, slightly thickened toward the upper insertion. Columella short, vertical, rather straightened, its edge reflexed but not closely appressed. Alt. 11, diam. 8 mill.

Mediterranean Sea; Atlantic coasts of Spain and France; north to South coast of England.

Bulla hydatis LINN., Syst. Nat. xii, p, 1183, 1766.—HANLEY, Ipsa L. Conch., p. 204.—SOWB., Illustr. Ind. Brit. Sh., pl. 20, f. 19.—HOGG, Tr. Roy. Mic. Soc., xvi, pl. 13, f. 78 (dentition).—*Bulla pisum* DELLE CHIAJE, An. s. Vert. iii, p. 26.—*Bulla hyalina* GMEL., Syst. xiii, p. 3432.—*Haminea elegans* of many authors.—HIDALGO, Moll. Mar. Esp., p. 3, pl. 21, f. 4, 5. Not *H. elegans* Leach!—*Bulla folliculus* MKE., Zeitschr. f. Mal., 1853, p. 141.—*Haminea hydatis* BUQ., DAUTZ. & DOLLF., Moll. Rouss. i, p. 515, pl. 163, f. 8, 9.

This species is distinguished from *B. navicula* by its smaller size, smoother surface, straighter columella, etc. The following color variations, sufficiently described by their names, have been noted by Monterosato: *major, media, minor, oblonga, globosa, virescens, albescens, violacea.*

For the facts relating to *Haminea elegans* see under West Atlantic species.

H. ORBIGNYANA Férussac. *Unfigured.*

Shell similar to *H. hydatis*, but outer lip dilated above, rising high above the vertex. Alt. about 12 mill.

Ocean coast of France, dept. Charente-Inférieure (Fischer); *Rochelle* (Fér.); *I. of Aix* (Le Bahezre); *I. of Ré* (Jeffr.); *Canary Is.* (McAndrew); also reported from *Falmouth* (Leach); *Dublin Bay* (Turton) and *Cork Harbor* (Humphreys).

Bulla orbignyana Ferussac, Dict. classique d'Hist. Nat., ii, p. 573, Dec., 1822.—Fischer, Journ. de Conch., 1879, p. 21.—*B. dilatata* Leach, Syn. Moll. G. B., p. 42, 1852.

West Atlantic and Antillean species.

Analysis of forms.

a. Vertex perforated, the lip arising on left side of perforation, and angled near its insertion.

b. Large, with close, conspicuous engraved spirals all over, *elegans.*

bb. Small, surface polished, with fewer spirals, *glabra.*

aa. Lip arising on right side of the center of the vertex, not angled.

b. Grooved throughout with distinct, spaced spirals, *solitaria, succinea.*

bb. Spiral striæ obsolete or excessively fine.

c. Shell subcylindrical, columella gently concave, *petitii.*

cc. Shell globose-ovate, columella very concave, *antillarum.*

H. elegans Gray. Pl. 41, figs. 37, 38, 39; pl. 40 fig. 88.

Shell *roundly oval or somewhat cylindrical, truncated above,* rounded below. Color pale brownish-yellow or pale greenish, fading to white at vertex and base. Surface with irregular growth wrinkles, sometimes rather coarsely plicated; and showing plainly to the naked eye, close, fine spiral striation. Under the lens the sculpture is seen to be formed of *clear-cut incised straight spirals,* as if machine engraved, the entire surface being scored with *minute, mingled with much coarser unequally spaced grooves.* Vertex concave and *minutely perforated,* the *outer lip arising from the left side of the perforation,* which is encircled by a crescentic projection from the parietal callus, *at the upper termination of which there is a salient angle of the arising lip.* Outer lip equably arched, well rounded above and below. Columella deeply arcuate, thin, with very narrow white reflexed and appressed edge, and a small fold above; parietal callus unusually thin.

Alt. 19, diam. 13 mill.

Alt. 20½, diam. 16 mill.

West coast of Florida and Texas; West Indies; St. Thomas, Curacoa, etc.; Rio Janeiro.

Bulla elegans GRAY, Annals of Philos. N. Ser. ix, p. 408, 1825; Index Testac. Suppl., pl. 3, *Bulla* f. 2 (Good!); and *Haminea elegans* LEACH, Syn. Moll. G. B., p. 42, at least in part. Not *H. elegans* of authors!—*Bullæ guildingii* SWAINS, Malacol. p. 360, and 251, f. 46.—*B.* (*Haminea*) *guildingii* AD. in Thes. p. 580, pl. 124, f. 87–89.—*H. guildingii* SOWB., Conch. Icon., f. 5.—MORCH., Mal. Bl. xxii, p. 174.—DALL, Blake Gastr., p. 57, and Cat. Mar. Moll. S. E. U. S., p. 88.—? *Bulla diaphana* Couth. in GOULD, Proc. Bost. Soc. N. H., iii, p. 91, 1849; Expl. Exped., p. 222, f. 265 (animal and shell).

This is one of the most distinct species. The engraved spirals are clearly visible without a lens, and are uncommonly clear cut and straight. The open apical perforation and the mode of insertion of the upper end of the lip are also good diagnostic features.

The description of *Bulla elegans* given by Gray applies undoubtedly to this form, not to any European species; and Leach's *H. elegans* is also the same, although he may have confused other shells with it. Leach always meant "spiral" by his term "longitudinal striæ." By no possible means can Gray's or Leach's descriptions be made to fit the *H. hydatis* of Europe. The spirals of that form would never have been seen by them, and it never attains the length of three-fourths of an inch.

The *B. diaphana* of Gould from Rio Janeiro, which I think is very likely synonymous, is illustrated on pl. 48, fig. 8.

H. GLABRA A. Adams. Pl. 43, fig. 18.

Shell *fragile, pellucid, translucent,* ovate, roundly truncate above, rounded below, color pale greenish-corneous. *Surface polished and shining,* showing under a strong lens some unequally spaced spiral incised striæ, fewer or obsolete in the middle. Vertex concave, *with a minute central perforation. Outer lip arising on the left side of the perforation,* which is surrounded by the continued parietal callus, at the termination of which there is a *salient angle of the rising lip.* Columella *very concave,* with narrowly reflexed edge, hardly folded above. Alt. 9, diam. 6 mill.

St. Thomas (Swift).

Bulla (*Haminea*) *glabra* A. AD., Thes. p. 581, t. 124, f. 96.—*Haminea glabra* SOWB., Conch. Icon., f. 27.—SMITH, Ann. Mag. (4), ix, p. 349.

This form is closely allied to *H. elegans* Gray, but is smaller, more polished and shining, and with the spiral striation far weaker.

H. SOLITARIA Say. Pl. 28, fig. 44; pl. 41, fig. 32.

Shell thin, subcylindrical, with gently convex sides, truncate vertex and rounded base; color horny or light brown. Surface shining, having irregular growth wrinkles and (under a lens) *fine, deeply impressed spiral grooves*, much narrower than their intervals, sometimes with smaller ones intercalated. Vertex white, somewhat impressed in the middle, subperforate. Lip arising to the right of the center, slightly thickened; outer lip gently arched forward. Columella thin, concave. Alt. 10, diam. 6½ mill.

Massachusetts Bay to South Carolina.

Bulla solitaria SAY, Journ. Acad. Nat. Sci., Phila., ii, p. 245, 1822. Complete writings of Thomas Say, W. G. B. edit., p. 84.—GOULD, Invert. Mass. (edit. W. G. B.) p. 222, f. 513.—DALL, Cat. Mar. Moll. S. E. U. S., p. 88.—*Bulla insculpta* TOTTEN, Journ. of Sci., xxviii, p. 350, f. 4,.—GLD., Inv. Mass., f. 92.—AD., Thes. f. 84.—SOWB., Conch. Icon., f. 1.—*Haminea novæ-eboraci* SOWB., C. Icon., f. 6, 1868.

This species has the spiral grooves unusually well developed. This, with the cylindric-oval form is the main distinctive character. The species occurs sparingly along the whole Atlantic seaboard. It has also been reported from high northern latitudes. See K. Svensk. Akad. Handl., 1878, p. 72, and Vega Exp., 370.

H. SUCCINEA Conrad. Pl. 48, fig. 18.

Shell fragile, horny or whitish, cylindrical, somewhat wider at base; vertex truncated, narrowly and deeply impressed, minutely perforated, the lip inserted on right side of perforation. Surface densely evenly and deeply striated spirally throughout, the striæ slightly wavy, aperture long, its upper five-eighths narrow and parallel sided, lower part expanded; columella very concave, folded above, the lip reflexed and closely appressed in the umbilical region. Alt. 10, diam 5⅜ mill.

Indian River to West Coast of Florida.

Bulla succinea CONR., Proc. Acad. Nat. Sci. Phila. iii, p. 26, pl. 1, f. 5, 1846.—AD. Thes. p. 584, pl. 124, f. 106.—*H. succinea* SOWB., Conch. Icon. f. 25.—DALL, Blake Gastr. p. 57; Proc. U. S. Nat. Mus. 1883, p. 324.

More cylindrical and elongated than *H. solitaria*, with the columella more concave.

H. ANTILLARUM d'Orbigny. Pl. 41, figs. 35, 36.

Shell *fragile, subtranslucent*, globose-ovate, narrower above, swollen below; color pellucid-horny, or slightly green tinted. Surface seen under a lens to be marked by growth striæ; and *under a high power* fine, close, rather effaced and wavy spiral striæ, but this is hardly seen with the ordinary hand lens. Vertex narrowly impressed, imperforate, the slightly thickened outer lip *arising from the right side of the center*, produced high above the vertex; outer lip produced forward above. Aperture more than twice as wide below as above; *columella very concave;* parietal callus light. Alt. 10, diam. 7–8 mill.

Tampa and southward, West Florida; St. Thomas; Porto Rico.

Bulla antillarum ORB., Moll. Cuba, i, p. 124, t. 4, f. 9–12.—*Haminea antillarum* MORCH., Mal. Bl., xxii, p. 175.—DALL, Blake Gastr., p. 57, and Cat. Mar. Moll. S. E. U. S., p. 88.—*Bulla (Haminea) cerina* MKE., Zeitschr. f. Mal., 1853, p. 142, cf. Mal. Bl. i, p. 45.—*Haminea guadaloupensis* SOWB., Conch. Icon., f. 14, 1868.

The typical *H. antillarum* is a small shell, nearly white in color. It is abundant on the west coast of Florida. *H. cerina* Mke. is, I believe, absolutely synonymous.

Var. GUADALUPENSIS Sowerby. Pl. 41, figs. 30, 31, 33, 34.

Shell thin, but rather solid, globose-ovate, *distinctly compressed above*, swollen below; the vertex narrow, concave in the middle. Color *greenish-yellow*, subtranslucent when young, rather solid and opaque when adult. Surface having irregular growth wrinkles, often even plicate above in adults, and showing under a strong lens, *excessively fine, close and somewhat wavy spiral striæ*. Outer lip slightly thickened toward its apical insertion, *where immediately to the right of the imperforate center of the vertex it is connected by a short vertical curve with the parietal callus.* It rises *high above the vertex, sweeps forward*, and then as it descends, backward to the broadly rounded basal lip. *Columella extremely concave*, with a very narrow white callus, making a small fold above; parietal callus light. Alt. 18, diam. 14 mill.

White Water Bay, West Florida, (Johnson); *Cuba, St. Thomas, Guadalupe, Tortola, West Indies.*

Much larger than *antillarum*, and more deeply colored. The contour is the same, except that in this the upper part is often more constricted.

This species is well distinguished by its swollen form, compressed above, excessively fine spiral striation, very deeply concave columella and greenish-yellow color. There is sometimes a slight umbilical chink behind the insertion of the lip at the vertex, but there is no trace of a true umbilicus at base. The flexure of the lip forward above is also noteworthy. (See figs. 31, 33).

H. PETITII d'Orbigny. Pl. 41, figs. 23, 24.

Shell cylindric-oval, truncated above, rounded below. Color light yellowish-green. Surface having indistinct growth-lines but free from spiral striæ at least under ordinary magnification. Vertex wide, somewhat impressed in the middle, imperforate, the outer lip arising immediately from the right of the center. Columella rather straightened, subvertical, its reflexed edge not appressed but leaving a narrow chink; not folded above.

Alt. 9, diam. 6 mill.

St. Thomas (Orb., Swift); *Tampa, west Florida* (Dall).

Bulla petitii ORB., Moll. Cuba i, p. 130, pl. 4 bis, f. 13–16.—*Haminea petitii* MORCH, Mal. Bl. xxii, p. 174.—DALL, Cat. Mar. Moll. S. E. U. S., p. 88.

This species is similar to *H. antillarum* in form of the apex and obsolescence of spiral striæ; but it is much more cylindrical and the columella is straighter than in any other West Indian *Haminea*. This is not well shown in Orbigny's figure.

West American species.

H. VESICULA Gould. Pl. 41, figs. 28, 29.

Shell thin and fragile, globose-oval, slightly narrowed above, rounded below. Color "pale greenish-yellow." Surface sculptured with indistinct growth-lines and close, fine microscopic spiral impressed striæ. Vertex narrowly but deeply impressed, imperforate; lip arising from *the left side of the center*, slightly but quite visibly *angulate or sinuous near the insertion;* lip bending forward above, broadly rounded at base. Columella very concave, with a narrow reflexed and appressed callus, folded above.

Alt. 18, diam. 13 mill.

San Pedro, California, south to Cape St. Lucas.

Bulla vesicula GLD., Rep. Expl. and Surv. Pacif. R. R. v, appendix, p. 334, 1854.—? *Haminea vesicula* SOWB., Conch. Icon., f. 19.—KEEP, West Coast Shells, p. 126, f. 116.

The insertion of the lip above is much as in *H. elegans* of the Antilles, but there is no apical umbilicus.

Var. VIRGO Pils. Pl. 41, figs. 25, 26.

Rather shorter and more swollen, translucent white.
Alt. 18, diam. 14 mill.

Santa Barbara, etc., California.

H. CYMBIFORMIS Carpenter. *Unfigured.*

Shell very thin, whitish, the axis contorted; much inflated, spire small, concealed. Aperture ventricose anteriorly, produced behind; ornamented with close spiral striulæ, growth lines subextant. Inner lip very thin. Only one rather imperfect specimen was found of this beautiful species, which resembles in form a small inflated *Cymbium*.
Length ·07, diam. ·05 inch.

Mazatlan.

Haminea cymbiformis CPR., Maz. Catal., p. 174.

May be a young shell, and perhaps the same as the last-described form, but Mörch reports it from Puntarenas, west coast Central America (Mal. Bl. vi, p. 123).

H. VIRESCENS Sowerby. Pl. 40, fig. 5; pl. 43 fig. 19.

Shell ovate, *much compressed and contracted above*, globularly expanded below; thin. Color greenish-yellow, subopaque. *Vertex very narrow*, impressed and minutely *perforated* in the middle; the rising outer lip thickened, inserted on the right side of the perforation, ascending far above the vertex. Upper third of aperture narrow, *lower two-thirds much dilated*, the columellar outline more arcuate. Columella simple and thin, regularly and deeply concave, with narrowly reflexed, appressed edge. Alt. 14, diam. 10½ mill.; often larger, alt. 18 mill.

San Pedro, San Diego, etc., California.

Bulla virescens SOWERBY, Genera of Shells, Cephala, pt. 39, *Bulla* fig. 2, (1833 ? See R. B. NEWTON Br. Olig. and Eoc. Moll. p. 322, and SHERBORN, Ann. Mag. N. H. (6), xiii, Apr., 1894, p. 371).

AD., Thes., p. 579, pl. 124, f. 83.—*H. virescens* SOWB., Conch. Icon. f. 22 (false? locality, "Pitcairn's Island").

This species is remarkable for the compression of the upper part of the whorl, more marked than in any other species.

H. PERUVIANA d'Orbigny. Pl. 43 figs. 3, 4, 5.

Shell oval, ventricose, very thin, transparent, greenish-yellow very finely spirally striated, visibly umbilicated. Aperture wide in front, narrow behind; columella with a prominent cord, which above, where it turns inward, is not applied to the epidermis but stands out in the form of a sharp lamina. Alt. 20 mill. Animal greenish-yellow, peppered with close black dots, less numerous below.

A salt lake near the sea, south of Callao, Peru.

Bulla peruviana ORB., Voy. dans l'Amér. Mérid., p. 211, pl. 19, f. 4–6 (under the name *B. hydatis*, on plate).—*Haminea natalensis* SOWERBY, Conch. Icon. f. 7, not of Krauss; *Cf.* E. A. SMITH, Ann. Mag. N. H. (4), ix, p. 347, 1872.

The color and striation is the same as in *H. navicula*, but *H. peruviana* is more swollen, less oblong, and the columella is elevated in a sharp plate above, not appressed as in the European species. The three stomach-plates are smooth. Pl. 41, fig. 27 represents the synonymous *H. natalensis* Sowb., the assigned locality of which is evidently incorrect. Orbigny's figures (copied on my plate) are double natural size.

Species of Japan and China.

H. ANGUSTA Gould. Pl. 40, fig. 93.

Shell small, thin ovate-cylindrical, widened in front, obtusely rounded; yellow-green, engraved with transverse striæ; vertex obliquely truncate, subperforate. Aperture enlarged in front; columella hardly excavated, folded and surrounded with a callus.

Alt. 6, diam. 4 mill. (*Gld.*).

Simoda, Japan (Stimpson).

Haminea angusta GLD., Proc. Bost. Soc. N. H. vii, p. 139.—*H. angustata* SOWB., Conch. Icon., f. 32. *Conf.* TRYON, Am. Journ. Conch. iv, p. 283, and SMITH, Ann. Mag. N. H. (4), ix, p. 348.

H. STRIGOSA A. Adams. *Unfigured.*

Shell cylindric-ovate, rounded at both ends, white, shining, subopaque, transversely most minutely striolate throughout, longitudinally streaked; aperture narrow, dilated in front; columellar margin simple, arcuate; lip straight, posteriorly produced and rounded (*Ad.*, Ann. Mag. (3), ix, p. 156).

Tabu-Sima, Japan, 25 fms.

White, with longitudinal slightly raised streaks, and entirely transversely striated. In form it resembles *H. lucida* A. Adams; but the aperture is rounded anteriorly, and not produced as in that species. (*Ad.*).

H. GRISEA Smith. *Unfigured.*

Shell shortly cylindrical, subplanate above, rounded below, thin, imperforate; blue-white under a thin gray epidermis, tinged with buff toward the apex, shining; most minutely and closely spirally striate, obsoletely decussated by arcuate growth-lines; aperture narrow above, slightly produced above the vertex, dilated at base; columella obliquely somewhat twisted; lip thin, inserted in the middle of the vertex and thickened there. Alt. 6, diam. 3 mill. (*S.*).

Off Japan, Lat. 42° 52′ *N., long.* 144° 40′ E., in 48 fms. (St. John).

Haminea grisea Smith, Ann. Mag. N. H. (4), xvi, 1875 p. 114.

H. corticata Möller, is the nearest ally of this species; but the lateral outlines of that species are more convex, and the epidermis of a more yellow color. In *H. grisea* the columellar portion of the body-whorl is of a yellowish color, and the termination of the slightly olive-grey epidermis is defined by a blackish edge. (*S.*).

H. EXARATA Philippi. Pl. 40, fig. 97.

Shell grooved by simple impressed transverse lines; superior angle of the aperture produced, base rounded.

Alt. 8, diam. 6, thickness 4 lines.

Northern China (Largilliert).

Bullæa exarata Ph., Zeitschr. f. Mal. 1849, p. 141.—*Haminea exarata* Mke., Mal. Bl. i, p. 46.—*B.* (*Haminea*) *sinensis* A. Ad., Thes. p. 584, pl. 104, f. 98.—*H. sinensis* Sowb., C. Icon., f. 21.

Adams' figure is copied on the plate, and his description is as follows: "Shell somewhat oval, open, semiopaque, white, longitudinally substriated, with transverse engraved lines rather wide apart; aperture very wide, anteriorly dilated, posteriorly produced."

H. FULGIDA A. Adams. *Unfigured.*

Shell elongate-cylindrical, white, thin, shining, subpellucid, rounded at both ends, transversely striolate throughout, striæ most minute and close; aperture narrow, dilated in front; columellar margin acute, arcuate; lip a little straightened, produced and angled behind. (*Ad.*, Ann. Mag. N. H. (3), ix, 1862, p. 155).

Shan-tung (*Kala-hai*), *China.*

This is a beautiful white, shining, semipellucid species, most like *H. curta* A. Adams, but more elongate and narrower, and engraved with very fine close set transverse striolæ. (*Ad.*).

H. LUCIDA A. Adams. *Unfigured.*

Shell cylindric-ovate, slightly rimate, rounded at each end, diaphanous, glassy, transversely striated throughout, the striæ most minute and close; aperture narrow, produced in front; columellar margin thin, arcuate; lip rounded posteriorly. (*Ad., t. c.*, p. 155).

Gulf of Lian-tung; Hulu-Shan Bay, China (Adams).

Like *H. brevissima* and *pygmæa* A. Adams. An examination of the animal shows it to belong to *Haminea*, the genus which in all probability includes its above-named congeners. In my Monograph of the family (Sowb., Thesaurus, *Bulla*); they are arranged under *Cylichnidæ*. (*Ad.*).

Polynesian Species.

H. CROCATA Pease. Pl. 40, fig. 3.

Shell ovate-elongated, moderately solid, yellow, becoming orange on the latter part of the last whorl, and opaque above and below. Surface shining, showing slight, irregular growth-wrinkles and excessively fine, close, superficial spiral crenulated striæ. Vertex narrow, very slightly impressed, imperforate or nearly so, opaque-white in the center; lip inserted on the right of the center of the vertex, thickened; outer lip well curved; columella moderately concave, with a reflexed white callus, not folded above.

Alt. 13, diam. 8½ mill.

Sandwich Is.

H. crocata Pse., P. Z. S. 1860, p. 19 (except descr. of animal); *t. c.* p. 432 (descr. of animal).—Sowb., Conch. Icon. f. 29.—Martens & Langk. Donum. Bism., p. 52.—Angas, P. Z. S. 1877, p. 189.—*H. adamsii* Dkr., Mal. Bl. viii, p. 40, 1861; *cf.* Mal. Bl. xxi, p. 49.

Angas reports this from Lake Macquarie, N. S. Wales.

Animal: Cephalic disk square, oblong, in advance of the shell, slightly notched at the center of the front side, at the posterior side provided with a pair of flat, rather broad, recumbent lobes, which are rounded at their extremities; lateral lobes reflected on the sides of the shell two-thirds of its length; foot extending beyond the shell posteriorly, and rounded at its termination. Color cinereous; pellucid. (*Pse.*).

H. galba Pease. Pl. 40, figs. 1, 2.

Shell oval, light, shining, yellowish; marked with longitudinal lines of growth, and finely microscopically spirally striated; outer lip nearly straight, and very slightly produced posteriorly; inner lip thickened somewhat at the base, and slightly reflected; columella strongly arched at lower part. (*Pse.*).

Sandwich Is.

H. galba Pse., P. Z. S. 1860, p. 432. Desc. of animal under *H. crocata* Pse., *t. c.*, p. 20.—Sowb., Conch. Icon., f. 23.

The shell of this species can hardly be distinguished from that of *H. crocata;* but the animal differs widely. (*Pse.*).

Animal: Cephalic disk large, oblong triangular, entire in front and truncated, bilobed posteriorly and lobes overlapping; lateral lobes reflected on the sides of the shell during locomotion, covering about one-half of its length, and nearly meeting on the back; posteterior lobe covering the spire; foot subquadrate, extending a short distance beyond the shell posteriorly; eyes central, immersed, black; surrounded by white areolae; color of the animal varying from grey to greyish-yellow and in some nearly to black, being closely mottled and freckled with olive or dusky. (*Pse.*).

H. pusilla Pease. *Unfigured.*

Shell small, cylindrically ovate, rather solid, white; surface finely cancellated; apex slightly umbilicated or perforated; aperture narrow, contracted posteriorly, slight fold at base of columella. (*Pse.*).

Sandwich Is.

H. pusilla Pse., P. Z. S. 1860, p. 20.

H. SANDWICHENSIS Sowerby. Pl. 40, fig. 4.

Shell pellucid, white, smooth, ovate, roundly subacuminate at each end, apex umbilicated; aperture rather narrow; columella rather straight with a slight plait. (*S.*).

Sandwich Islands.

H. sandwichensis SOWB., Conch. Icon., f. 24, 1868.

Differing from *H. galba* in color, in being more ovate and more acuminate at the ends (*Sowb.*). But probably synonymous with some of Pease's species.

H. NIGROPUNCTATA Pease. Pl. 40, fig. 100; pl. 43, fig. 13.

Shell thin, subpellucid, suboval, transversely very minutely and closely wrinkled striate, imperforate: lip straight, aperture anteriorly dilated; columella deeply arched at lower part and laminately callous. Chestnut-tawny. Alt. 16, diam. 10 mill. (*Pse.*).

Animal subpellucid, side lobes rather posterior. Foot wide, moderately extended behind the shell, truncate in front and bluntly rounded behind. The whole of the animal covered with crowded black dots, which are the largest and most conspicuous, as seen through the transparent shell. Station on seaweed in shallow water. (*Pse.*).

Raiatea (Pse.); *Tahiti* (Mts.).

H. nigropunctata PSE., Amer. Journ. Conch. iv, p. 71, pl. 7, f. 1 (animal), pl. 12, f. 19 (shell).—MARTENS, Donum Bism., pl. 52, pl. 3, f. 1.

H. OVALIS Pease. Pl. 40, fig. 94; pl. 43 figs. 9, 10.

Shell thin, fragile, pellucid, white or greenish, rather obliquely oval, smooth, somewhat roughened by striæ of growth, imperforate; aperture narrow posteriorly, dilated anteriorly; lip somewhat involute, columella callus on its lower part. Alt. 9, diam. 6 mill. (*Pse.*).

Animal pale watery green, closely dotted with orange and purple. The portion seen through the shell is spotted obscurely with cream yellow, their margin powdered with white. Foot cream-white, remotely dotted with pale orange. Side lobes not extending back over one-half of the shell. Foot regular in width, rather sharply rounded behind. (*Pse.*).

Tahiti (Pse.).

H. ovalis Pse., Amer. Journ. Conch. iv, p. 71, pl. 7, f. 2 (animal), pl. 12, f. 20 (shell).

H. APERTA Pease. Pl. 43 fig. 17.

Shell thin, pellucid, smooth, ovate, imperforate, white, very finely and irregularly striate longitudinally; outer lip slightly expanded above; aperture narrow posteriorly, anteriorly dilated; columella deeply arched below, and strongly callus; callosity somewhat reflexed, rather broad. Alt. 15, diam. 9 mill.

Tahiti.

H. aperta Pse., Am. Journ. Conch. iv, p. 72, pl. 12, f. 22.

Approaches *H. cymbalum* Quoy, but more ovate, outer lip not being so much expanded.

H. SIMILLIMA Pease. Pl. 40, fig. 95; pl. 43, figs. 11, 12.

Shell thin, fragile, pellucid, white, abbreviately oval, imperforate; aperture narrow above, dilated below, columella arched anteriorly and callous; lip slightly involute. Alt. 8, diam. 6 mill.

Animal pale green, the portion seen through the shell darker, everywhere conspicuously dotted with rich orange, with a few spots of purplish interspersed. Foot cream color, with close orange dots. Posterior portion of the foot narrow, extending some distance beyond the shell, and terminating in a sharp point. (*Pse.*).

Tahiti.

H. simillima Pse., Am. Journ. Conch. iv, p. 72, pl. 7, fig. 3 (animal), pl. 12, f. 21 (shell).—Martens, Donum Bism., p. 52.

H. nigropunctata and *H. simillima* resemble each other closely in both animal and shell. The latter species is much smaller and differs somewhat in color, and especially in the shape of its foot, which is constant.

H. OVOIDEA Quoy & Gaimard. Pl. 28, figs. 31, 32.

Shell ovate, fragile, white, slightly umbilicate, transversely striated in front, and with delicate longitudinal striæ.

Alt. 6, diam. 4 lines. (*Q. & G.*).

Humata, Island of Guam.

Bulla ovoidea Q. & G., Zool. de l'Astrol. ii, p. 348, pl. 26, f. 17–19 (not of A. Ad. nor Sowb.).

H. CYMBALUM Quoy & Gaimard. Pl. 40, figs. 6, 7.

Shell fragile, pellucid, globose, smooth, white; aperture wide in front, narrowed behind; right margin lightly inflated; spire retuse. A small species, globulose entirely white, translucid and polished, with slight growth-lines. Aperture large, rounded in front, contracted behind; vertex rounded and impressed but imperforate, the lip rising a little above it. Alt. 7, diam. 5 lines.

Island of Guam (Astrolabe).

Bulla cymbalum Q. & G. Zool. Astrol. ii, p. 362, pl. 26, f. 26, 27. —AD., Thes., p. 580, pl. 124, f. 90.—*Haminea cymbalum* SOWB., Conch. Icon., f. 20.—ANGAS, P. Z. S. 1865, p. 188.—LISCHKE, Jap. Meeres-Conch., p. 105.—DKR., Ind. Moll. Mar. Jap., p. 166.—MARTENS, Mobius' Reise n. Mauritius, p. 303; Monatsber. Berl. Akad. Wissensch. 1879, p. 737.

Angas reports this species from "Port Lincoln, in deep water;" Lischke from Nagasaki, Japan; Montrouzier from New Caledonia; Lienard from Mauritius; Deshayes from Réunion, and von Martens found it in Peters' collection from the Querimba Is. It remains to be seen whether all of these data really apply to Quoy's species.

Species of S. Africa, Red Sea, Philippines to N. Australia.

H. NATALENSIS Krauss. Pl. 40, figs. 80, 81.

Shell ovate-globose, subventricose, very thin, pellucid, shining, greenish-yellow, longitudinally striated; vertex impressed but imperforate. Aperture ample, dilated behind; outer margin arcuate, produced above, rounded. Alt. 4·4, diam. 3·3 lines. (*Kr.*).

Natal (Krauss); *Black River, Mauritius* (Möbius)

Bulla natalensis KRAUSS, Die Südafrik. Moll., p. 71, pl. 4, f. 14. —*H. natalensis* MARTENS in Möbius' Reise n. Maurit., p. 303. Not *B. natalensis* A. Ad. in Sowb., Thes. pl. 124, f. 86, nor *H. natalensis* Sowb., in Conch. Icon., f. 7.

The lip is much produced above the vertex, as in *H. orbignyana* and *H. antillarum*. Both A. Adams and Sowerby have figured specimens under the name *natalensis*, but in neither case are they the same as Krauss' species, nor do they agree with each other.

H. PETERSI Martens. *Unfigured.*

Shell thin, oblong, sculptured with rather wide, light, subvertical striæ, pale yellowish, a little narrowed above, scarcely umbilicated; upper margin of aperture rising above the spire, narrowly rounded; columellar margin deeply receding, a little thickened and simple. Length 19, greater diam. 13, lesser 11 mill.; aperture, length 23, width below, 7½ mill. (*Mts.*).

Mozambique (Peters).

Haminea petersi Mrs., Monatsbr. K.-P. Akad. Wissensch. zu Berlin, 1879, p. 737 (1880).

Nearest allied to *H. galba* Pse., but the columellar margin shows no fold and is more strongly retreating.

H. PEMPHIS Philippi. Pl. 40, fig. 87.

Shell subglobose-rotund, thin, pellucid, rufescent white, sculptured with very fine transverse lines; vertex umbilicated; aperture dilated at base, inner lip narrowly adnate.

Alt. 7, diam. 5½ lines. (*Ph.*).

Red Sea (Gruner).

B. pemphis Ph., Zeitschr. f. Mal. 1847, p. 122, not of A. Ad. nor Sowb.; see Smith, Ann. Mag. N. H. (4), ix, p. 347.—*Bulla* (*Haminea*) *tenella* A. Ad., Thes. p. 583, pl. 124, f. 104.—*Haminea tenella* Sowb., Conch. Icon., f. 18.

The figure represents Adams' *tenella*, which is thus described: "Shell oval, anteriorly somewhat narrowed, thin, fragile, horny, pellucid, somewhat gibbous in the middle, longitudinally substriated, with transverse irregular ridges and very fine lines; outer lip rather angulated in the middle, posteriorly produced and rounded."

H. SAVIGNYANA Gray. *Unfigured.*

Shell ovate-oblong, buff, thin, pellucid, smooth; vertex imperforate; aperture narrow; columellar margin subreflexed. Length one-half inch. (*Gray*, Annals of Philos. (N. S.), ix, 1825, p. 408).

Red Sea (J. E. Savigny).

H. CURTA A. Adams. Pl. 40, figs. 84, 85.

Shell elongately cylindrical, thin, pellucid, white, extremities truncated, entirely transversely striated, striæ engraved, rather wide apart; outer lip straight, posteriorly produced. (*Ad.*).

Sandwich Is. (Mts.); *Red Sea* (H. Ad.); *Suez* (Smith).

B. (*Haminea*) *curta* Ad. in Thes. p. 582, pl. 104, f. 100.—*H. curta* Martens, Donum Bism. p. 53.—*H. æquistriata* Smith, Ann. Mag. N. H. (4), ix, p. 350.—*Atys* (*Alicula*) *isseli* H. Ad., P. Z. S. 1872, p. 11, t. 3, f. 13. *Conf.* Cooke, Ann. Mag. N. H. (5), xvii, p. 130.

The synonymy is that given by Cooke. Martens remarks that the spiral striation and elongated contour resembles *Atys*. Fig. 85 represents the synonymous *A. isseli* of H. Adams. Smith's description is as follows: *H. æquistriata*, shell oblong, cylindrical, with rounded sides, white, pellucid, thin, shining, striated with irregular growth-lines and transverse lines; *striæ* (about 36) *equidistant or nearly so;* vertex depressed, aperture rather wide, dilated at base; the thin lip inserted in the middle of the vertex; columella curved, slightly reflexed. Alt. 12, diam. 6 mill.

H. rugosa Smith. *Unfigured.*

Shell cylindrical with curved sides, white, pellucid; above lightly, below distinctly striated, irregularly roughened by growth-lines; vertex little depressed; aperture rather wide, dilated at base; lip thin, subangulate above and inserted in the middle of the vertex; columella short, reflexed, nearly covering a narrow chink, subtruncate. Alt. 6, diam. 3 mill. (*S.*).

Gulf of Suez and Persian Gulf.

H. rugosa Smith, Ann. Mag. N. H. (4), ix, p. 35, 1872.

This shell belongs to the same group as *brevis* Q. & G. It is peculiar for the longitudinal irregular wrinkles formed by occasional deep lines of growth. (*S.*).

H. fusca A. Adams. Pl. 40, figs. 89, 90.

Shell globosely ovate, inferiorly subventricose, thin, semiopaque, longitudinally obliquely striated, with very fine transverse lines, internally fuscous. (*Ad.*).

Shell subovate, thin, very finely interruptedly irregularly and wavily striated, fawn-colored within, iron-brown without; sides rather straight; aperture pyriform, outer lip elevated above, subacuminated, produced near the upper terminus; columella arched. (*Sowb.*).

Cagayan, Mindanao, in 25 fms. (Cuming).

Bulla (*H.*) *fusca* Ad., Thes. p. 581, pl. 124, f. 94.—*H. fusca* Sowb., Conch. Icon. f. 10.—*H. ferruginea* Chemnitz, Sowb., Conch. Icon. f. 30. *Conf.* Smith, Ann. Mag. N. H. (4), ix, p. 348.

The "*Bulla ferruginosa* Chemn." or rather, Gmelin (Syst., p. 3432) is a young *Cyprœa*.

H. PERFORATA Philippi. *Unfigured.*

Shell ovate-rotund, thin, pellucid, white, sculptured with very fine transverse lines; vertex umbilicated; aperture *dilated* at base; *inner lip forming an umbilical fissure.*

Alt. 8, diam. 5½ lines. (*Ph.*).

Manila (*Largilliert*).

Bulla perforata PHIL., Zeitschr. f. Mal. 1847, p. 122.—*B. elegans* A. AD. (description, not figure), Thes. p. 580. Not *B. elegans* Gray.

Very like *B. hydatis* and *B. ovoidea;* differing from the first by the umbilical fissure; from *ovoidea* in the less narrow mouth dilated at base. (*Ph.*).

Adams' description is copied from Philippi, but his figure represents the West Indian *H. elegans* Gray. Sowerby describes and figures the true *elegans*, but quotes Arthur Adams as authority for that name, and retains the borrowed locality "Manila." There is of course no occasion whatever for confusing the West Indian *H. elegans* with the oriental *H. perforata;* the characters and locality given by Philippi amply distinguishing his species.

H. CONSTRICTA A. Adams. Pl. 40, figs. 98, 99.

Shell oblong, ovate, narrowed towards the spire, constricted with a linear impression, anteriorly produced, thin, pellucid, horny, subfuscous, with very fine transverse lines, longitudinally somewhat striated. (*Ad.*).

Sorsogon, Luzon, Philippines, at low water (Cuming); *Japan* (Schr.).

B. (*H.*) *constricta* A. AD., Thes. p. 581, pl. 124, f. 95.—*H. constricta* SOWB., Conch. Icon. f. 16.—SCHRENCK, Amurl. Moll., p. 462.

H. VITREA A. Adams. Pl. 40, fig. 83.

Shell ovately cylindrical, white, pellucid, longitudinally substriated, under the lens very finely transversely striated; outer lip rather straight, posteriorly produced and rounded. (*Ad.*).

Cagayan, Mindanao, and Luzon, Philippines, (Cuming); *Bet Island, Torres Straits,* inside the reefs on the sands (Brazier).

B. (*H.*) *vitrea* Ad., Thes. p. 583, pl. 124, f. 102.—*H. vitrea* Sowb. Conch. Icon. f. 8.—Braz., P. L. S. N. S. W. ii, p. 84.

H. TENERA A. Adams. Pl. 40, fig, 82.

Shell obliquely oval, horny, pellucid, longitudinally strongly striated, rather green, with very minute transverse lines; outer lip straight, posteriorly rounded. (*Ad.*).

Suez (Cooke); *Mauritius* (Lien. Möbius); *Réunion* (Desh).

B. (*H.*) *tenera* Ad., Thes., p. 583, pl. 124, f. 103.—*H. tenera* Sowb. Conch. Icon. f. 3.—Cooke, Ann. Mag. N. H. (5), xvii, p. 130.—Martens, Möbius' Reise, p. 303.

Cooke considers this identical with the prior *H. vitrea.*

H. PAPYRUS A. Adams. Pl. 40, fig. 91.

Shell cylindrical, in form of a roll of paper, anteriorly slightly dilated, white, semipellucid, extremities truncated, slightly rounded, longitudinally somewhat striated, entirely covered with transverse engraved lines, lines rather wide apart (*Ad.*).

Borneo (Cuming); *Darnley Island, Torres Straits*, 30 fms. (Brazier).

B. (*H.*) *papyrus* A. Ad., Thes. p. 582, pl. 124, f. 101.—*H. papyrus* Sowb., Conch. Icon. f. 17.—Brazier, Proc. Linn. Soc. N. S. Wales ii, p. 83.

H. AMBIGUA A. Adams. Pl. 40, fig. 8.

Shell ovately cylindrical, white, pellucid, anteriorly attenuated, entirely transversely striated, striæ engraved, wide apart; outer lip somewhat arched (*Ad.*).

"*Port King George, New Ireland*" (Mus. Cuming); *Réunion* (Desh.).

B. ambigua Ad., Thes. p. 582 pl. 124, f. 97.—*H. ambigua* Sowb., C. Icon. f. 26.—Desh., Moll. Réun. p. 54.—Mts., Möbius' Reise p. 303.

This form has somewhat the aspect of an *Atys.*

Australian and New Zealand Species.

H. DECORA Brazier. *Unfigured.*

Shell ovately cylindrical, white, thin, pellucid, longitudinally finely striated, transversely striated with 16 deep engraved lines, rather wide apart, eight being at each end, center smooth; aper-

ture rather wide, outer lip slightly arched, somewhat acuminately produced above, expanded below, columella nearly straight, reflected, producing behind it a minute umbilicus. Length 3 lines, breadth 1½ lines, alt. 1¼ lines (*B.*).

Cape Grenville, Northeast Australia, 20 fathoms, sandy mud; *Albany Passage, Cape York, North Australia,* 11 fathoms, sandy mud and broken shells.

Haminea decora Braz., Proc. Linn. Soc. N. S. Wales, ii, p. 83, 1877.

May prove to belong to *Atys,* but as it is unfigured and not seen by me, I do not venture to alter Mr. Brazier's generic reference.

This species differs very much from *Haminea ambigua* (A. Adams), the center of the shell being smooth, and each end having eight deep transverse engraved lines, whereas *H. ambigua* is entirely transversely striated.

H. cuticulifera Smith. Pl. 41, fig. 13.

Shell elongate-cylindrical, above and below roundly quadrate, thin, white; covered with a whitish epidermis, shining, buff tinged toward base and vertex; having growth lines, and above and at base subdistantly transversely striated. Aperture rather wide, dilated at base, scarcely produced above the vertex; columella short, rather straight, reflexed, covering the umbilical region, joined with the vertex by a very thin scarcely shining callus; lip thin, inserted in the middle of the vertex and thickened there. Alt. 14, diam. 6½ mill. (*S.*).

Port Jackson, 2–15 fms. (Coppinger, Challenger, Angas); *Levuka, Fiji,* 12 fms. (Challenger); *New Zealand.*

H. cuticulifera Smith, Ann. Mag. N. H. (4), ix, p. 350, 1872; Zool. Col. H. M. S. 'Alert,' p. 87, pl. 6, f. H.—Angas, P. Z. S. 1877, p. 189.—*Cylichna cuticulifera* Smith, Watson, Chall. Gastr. p. 663.

The lateral outlines of this species are nearly straight; the superior striæ are about six in number, the inferior about eighteen. *H. papyrus* A. Ad. is its nearest ally; but it is narrower, more elongate, with the striæ not covering the whole of the shell, the vertex is more depressed and the aperture is less broadly dilated and more effused at the base (*S.*).

This species belongs to a group of forms somewhat similar to certain species of *Cylichna* and *Atys,* like *H. decora* Braz. and *papyrus*

Ad. *H. brevis* Quoy is a shorter shell with more convex outlines. The New Zealand habitat has not been confirmed by local conchologists. Watson remarks: "This species is peculiar in combining a very cylindrical form with a very narrowly reverted and truncated pillar lip. Mr. E. A. Smith, who kindly examined my specimens, remarks that the British Museum 'specimens have the apical foramen covered by a thin callosity,' which is not present in most of the Challenger specimens. It seems to be very easily abraded."

H. BREVIS Quoy & Gaimard. Pl. 40, figs. 9, 10, 96.

Shell small, rather solid, cylindrical, the ends truncated, white, striated below. Aperture quite wide throughout its length; vertex a little impressed, imperforate; anterior extremity striated with 20 transverse lines, the rest of the shell smooth, showing growth-striæ under a lens. Animal white. Stomach containing three oblong deeply toothed plates. Alt. 5, diam. 3 lines (average).

Port of King George, Southwestern Australia (Astrolabe); *Port Lincoln, Middle Harbor, and Port Stephen* (Angas).

Bulla brevis Q. & G., Zool. Astrol. ii, p. 358, pl. 26, f. 36, 37. AD., Thes. p. 581, pl. 124, f. 93.—*H. brevis* SOWB., C. Icon. f. 15.—ANGAS, P. Z. S. 1865, p. 188; 1867, p. 227.—*Bulla ovoidea* MKE. (not Q. & G.), Moll. Nov. Holl. Spec.; *cf.* MKE., Zeitschr. f. Mal. 1844, p. 55.

H. WALLISII Gray. *Unfigured.*

Shell ovate, oblong, buff, pellucid, most minutely spirally striated, concentrically substriate; columellar margin subreflexed, white. Vertex imperforate; aperture coarctate posteriorly. Length one-fourth inch (*Gray*, Annals of Philos. [N. S.], ix, 1825, p. 408).

New Holland (Capt. Wallis).

H. ZELANDIÆ Gray. Pl. 41, figs. 11, 12; pl. 40, fig. 86.

Shell thin, subglobular-oval, covered with a thin pale straw-colored epidermis; white at vertex and columella. Surface showing some slight growth wrinkles, but without spiral striæ, although under strong magnification many short transverse impressions roughen the surface. Vertex slightly and narrowly impressed, imperforate, the slightly thickened lip reflexed at center of the vertex, produced above; outer lip regularly convex; basal lip broadly

rounded. Columella very concave, its edge reflexed and closely appressed.

Alt. 22, diam. 19 mill.

Alt. 13, diam. 10½ mill.

Auckland, New Zealand.

Bulla zelandiæ GRAY, in Dieffenbach's New Zealand ii, p. 243, 1843.—SMITH, Zool. Erebus and Terror, Moll. p. 5, pl. 1, f. 10 (Gray's type figured).—*Haminea zealandiæ* HUTTON, Man. N. Z. Moll. p. 121.—GILLIES, Trans. N. Z. Inst. xiv, p. 171.—*H. obesa* SOWB., Conch. Icon. f. 13.—*B.* (*H.*) *pemphis* Phil., AD., Thes. p. 580, pl. 124, f. 91.—*Haminea pemphix* Phil., SOWB., Conch. Icon. f. 12. Not *B. pemphis* Philippi, *conf.* Smith, Ann. Mag. N. H. (4), ix, p. 347.

An unusually globular species, everywhere well rounded, with no distinct spiral sculpture even under the lens. Fig. 86 represents the synonymous *H. pemphix* Ad. and Sowb., not Phil. Fig. 11 is the type of *zelandiæ*, and f. 12 is Sowerby's *H. obesa*.

H. CASTANEA A. Adams. Pl. 41, fig. 14.

Shell solid, oblong, oval; spire umbilicated, whitish, covered with a brown ferruginous epidermis, engraved (under the lens) with very fine close-set lines, the anterior ones very distinct and wide apart, longitudinally substriated; inner lip anteriorly white and thickened; aperture white within (*Ad.*).

New Zealand (Ad.).

B. (*H.*) *castanea* AD., Thes. p. 584, no. 78*a*, pl. 124, f. 106*a*.—*H. castanea* SOWB., C. Icon. f. 28.

The locality lacks confirmation by New Zealand naturalists.

Species of unknown habitat.

H. FLAVESCENS A. Adams. Pl. 41, fig. 15.

Shell small, suboval, anteriorly semitruncated, yellowish, pellucid, longitudinally substriated, with very minute transverse lines very close together; outer lip posteriorly angled and rounded (*Ad.*).

Habitat unknown.

B. flavescens A. AD., Thes. p. 582, pl. 124, f. 99.—*H. flavescens* SOWB., Conch. Icon. f. 31.

H. MALLEATA Smith. *Unfigured.*

Shell whitish, subpellucid, quadrate-ovate, irregularly malleated, striated transversely delicately, and with growth lines; aperture

rather wide, dilated and somewhat effuse at base; lip scarcely produced above the flat vertex, in the center of which it is inserted; columella deeply arcuate, callous, reflexed. Alt. 12, diam. 8 mill. (*S.*).

Habitat unknown.

H. malleata SMITH, Ann. Mag. N. H. (4), ix, 1872, p. 349.

This species is remarkable for its short squarish form, the irregular malleation, the reflected columella, and flattened vertex. Here and there are longitudinal depressions, giving the shell a somewhat wrinkled appearance (*S.*).

H. PERPLEXA Smith. *Unfigured.*

Shell ovate-cylindrical, bluish-white, pellucid, above and below opaque, milky, and transversely distantly striated, smooth in the middle, striated with growth-lines. Vertex deeply depressed, subperforate in the middle; aperture narrow, slightly produced above the vertex, the base somewhat wider; columella simple, slightly reflexed. Alt. 14, diam. 7½ mill. (*S.*).

Habitat unknown.

H. perplexa SMITH, Ann. Mag. N. H. (4), ix, p. 350, 1872.

This species has much of the aspect of the genus *Atys;* but is without the sinuosity of the labrum at the vertex, and is there slightly perforated. The superior striæ are about seven in number, the inferior about twice as many (*S.*).

H. ROTUNDATA A. Adams. Pl. 41, fig. 16.

Shell roundly ovate, thin, horny, semipellucid, rounded at both ends, longitudinally striated under the lens, with very fine transverse lines; outer lip equally arched (*Ad.*).

Habitat unknown.

B. (H.) rotundata A. AD., in Thes. p. 583, pl. 104, f. 105.—*Haminea rotunda* SOWB., C. Icon. f. 9.

Sowerby drops a syllable from this name.

H. SERICA Smith. *Unfigured.*

Shell rotundly ovate, very thin, pellucid, whitish, slightly shining, finely and closely striated transversely and with growth lines; aperture rather wide, produced somewhat above the vertex, dilated at base; columella little thickened, spirally twisted; umbilical region

covered with a thin, scarcely shining callus, which continues to the vertex. Alt. 11, diam. 9 mill. (*S.*).

Habitat unknown.

H. serica E. A. Smith, Ann. Mag. N. H. (4), ix, p. 349, 1872.

This is a remarkably roundly ovate species, very finely transversely striated, which produces a somewhat silky appearance, and having the region of the umbilicus covered by a very thin dull callosity, which is extended along the whorl to the vertex. Although the sculpture is very like that of the *H. insculpta* Totten, the form is very different (*S.*).

Genus AKERA Müller, 1776.

Akera Mull., Zool. Danicæ, Prodr. seu Anim. Dan. et Norv., etc., p. 242, type *A. bullata*.—A. Ad., Thes. Conch., ii, p. 572.—*Acera* of many authors.—*Aceras* Locard.—*Eucampe* Leach, Syn. Moll. Gt. Brit., p. 42.

Shell ovate or oval-cylindric, *thin, fragile,* elastic, with *exposed, nearly level spire* of several whorls. Last whorl *acutely keeled* at the shoulder, *the keel bounding a flat anal fasciole.* Aperture nearly as long as the shell, narrow above and *extending in a deep sinus along the suture,* dilated below and very effuse, permitting all the whorls to be seen from the base through the spirally ascending columella. Columella very concave, thin, with narrowly reflexed edge. Type *A. bullata.*

Animal not completely retractile; *head disc depressed, long and narrow,* truncated in front, tapering behind; eyes lateral, distinct. Mantle rudimentary, enclosed in the shell, having a posterior fleshy lobe passing backward and ascending the spire in the anal fasciole. Foot long and narrow; parapodial lobes very large, reflexed over the shell, (pl. 48, fig. 5, *A bullata*). Stomach containing about a dozen subtriangular, pointed, large and small cartilaginous plates.

Jaws (pl. 61, fig. below f. 26, and fig. 29) separate, oval, reticulated.

Radula (pl. 61, figs. 30, 31, *A. bullata*) composed of many longitudinal rows. Central tooth subtriangular with bilobed base and reflexed, serrate cusp. Inner laterals falcate, with long serrate cusps; outwardly the cusps become longer and gradually lose the serration, the outer teeth being acicular.

The shell of this genus is peculiar in its sutural sinus or slit, and the wholly exposed spire. The animal is characterized by the very long and narrow head shield, the epipodial lobes being as in *Haminea*. The dentition also resembles that of *Haminea*, but the stomach is differently armed.

The young animals use the epipodial lobes as swimming organs, flitting about like butterflies.

A. BULLATA Müller. Pl. 42, figs. 11, 12, 17.

Shell fragile, ovate, squarely truncated above, the spire nearly flat and encircled by an acute keel as in *A. soluta;* covered with a thin pale brownish epidermis; surface densely microscopically striated. Aperture nearly as long as the shell, narrow above and deeply sinused, gradually widening below, becoming broadly rounded at base; outer lip arched forward in the middle; columella simply arcuate with a thin reflexed, appressed callus. Alt. 14, diam. 9 mill., sometimes larger, alt. 28 mill.

Norway and seas of North and West Europe generally; Mediterranean.

Akera bullata MULL., Zool. Danica, p. 242, pl. 71, f. 1–5 (1776). —FORBES & HANLEY, Hist. Brit. Moll., p. 527, pl. 114d, f. 4–6 (shell); pl. vv, f. 6 (animal).—SOWB., Conch. Icon., f. 6.—*Acera bullata* MEYER & MOBIUS, Fauna Kieler Bucht., p. 81, plate (animal).—SARS, Moll. Reg. Arct. Norv., p. 281, pl. 26, f. 1 (shell), pl. xii, f. 17 (dentition, anatomy).—LANGERHAUS, Zeitschr. Wissensch. Zool., xxiii, p. 171, pl. 8 (embryology), abstract in Zool. Rec., ix, p. 151.—MAZZARELLI, Zool. Anzeiger, xiv, p. 241, f. 6 (genitalia).—VAYSSIERE, Rech. Moll. Opisth., p. 23.—JEFFREYS, Brit. Conch., iv, p. 430; v, pl. 95, f. 1.—*Aceras bullatum* LOCARD, Coq. Mar. France, p. 24, f. 11.—*Bulla akera* GMEL., Syst. Nat. (13), p. 3434, and of MONTAGU, FLEMING, DILLWYN, WOOD, and other early English conchologists.—*B. norvegica* BRUG, Encycl. Méth., i, p. 377, pl. 360, f. 4.—*Bulla resiliens* DONOVAN, Nat. Hist. Brit. shells, pl. 79, (1804).—*B. fragilis* LAM., An. s. Vert. (edit. Dh.) vii, 672.—BLAINV., Man. Malac., pl. 45, f. 7.—SOWB., Conch. Man., f. 247.—*Akera flexilis* BROWN, Illustr. Conch. G. B., p. 59, pl. 19, f. 31, 32. —*B.* (*A.*) *bullata* A. AD., Thes. p. 572, pl. 121, f. 41.—*B.* (*A.*) *hanleyi* A. AD., *l. c.* p. 573, pl. 121, f. 46.—*Eucampe donovani* LEACH, Syn. Moll. G. B., p. 42.—*Bulla canaliculata* OLIVI, *et. al.*, and possibly of LINNÆUS, see HANLEY, Shells of Linn., p. 207.—

B. globosa CANTRAINE, Mal. Medit., p. 82.—*B. elastica* DANILO & SANDRI, Gast. Test. Mar., p. 26, (1856), *cf.* BRUSINA, Contr. pella Faun. Moll. Dalm., p. 10.—*Aceras elegans* LOCARD, Coq. Mar. France, p. 24.

Smaller, more tapering toward the ends and less cylindrical than *A. soluta.* Long as is the above list of references, it could readily be doubled; but everything of value is believed to be here included.

A. SOLUTA Gmelin. Pl. 42, fig. 18.

Shell large, fragile, cylindrical, tapering toward the ends; covered with a thin pale yellowish-brown epidermis. Spire projecting but low and obtuse, terraced; shoulder of whorls acutely keeled, a flat, wide anal fasciole between keel and the deeply impressed suture. Whorls nearly 5, the first one a minute, uptilted and half immersed apical nucleus; body whorl forming most of the shell, densely spirally striated throughout. Aperture narrow in its upper half, with a wide posterior sinus extending back about a third of a whorl; lower half dilated and ovate, effuse at base. Outer lip fragile, arching forward in the middle; columella very concave, with a narrowly reflexed cord-like edge. Alt. 45, diam. 25 mill.

Zanzibar; Querimba Is. (Peters); *Mauritius* (Lienard); *Ceylon* (Thorne); *Philippines* (Cuming); *Torres Straits* (Cuming); *Port Jackson, Port Lincoln, Hardwick Bay, Botany Bay, etc., New South Wales* (Angas); *Spencer's Gulf, S. Australia* (Angas).

Bulla soluta GMEL., Syst. Nat. (13), p. 3434.—A. AD., Thes ii, p. 572, pl. 121, f. 40.—*Akera soluta* SOWB., C. Icon., f. 4.—ANGAS, P. Z. S., 1865, p. 189; 1867, p. 227.—SMITH, Zool. Coll. Alert, p. 87.—MARTENS, Möbius' Reise n. Maurit., p. 303; Monatsber. K. Akad. Wissensch., 1879, p. 738, and of many authors.—*B. ceylanica* BRUG., Encyc. Méth., i, p. 377.—*B. (A.) tenuis* A. ADAMS, Thes. ii, p. 573, pl. 121, f. 45.—SOWB., C. Icon., f. 7.

The spire in this form projects more than in any of the other species. It varies much in size, some Australian specimens being less than half the dimensions given above. Fig. 16 of plate 42 represents the *A. tenuis* of Adams, which Angas and Smith agree is a synonym. A. Adams and Sowerby have given an incorrect synonymy. The animal has been figured by Arthur Adams (Zool. Samarang, pl. 18, fig. 2).

A. BICINCTA Quoy & Gaimard. Pl. 42, figs. 15, 13.

Shell ovate-oblong, very thin, fragile; white, encircled by two reddish bands; surface with longitudinal and transverse striæ; suture fissured. This Bulla has almost entirely the form of the fragile Bulla [*A. bullata*], only the right margin is more developed and the aperture wider below. Alt. 1 inch, diam. 8 lines. (*Q. & G.*).

Harbor of the Princess Royal, King George's Sound (Q. & G.).

B. bicincta Q. &. G., Zool. Astrol., ii, p. 355, pl. 26, f. 31, 32.—A. AD., Thes. p. 573, pl. 121, f. 44.—SOWB., C. Icon., f. 5.

A. TUMIDA A. Adams. Pl. 42, fig. 14.

Shell horny, fragile, ovately cylindrical, spire rather flattened, semipellucid, tumid in the middle, and rather gibbous near the inner lip, encircled with a faint, scarcely conspicuous fuscous band, transversely very finely striated, longitudinally somewhat plicated; aperture anteriorly very much dilated. (*Ad.*).

New Zealand (Adams).

B. (*Akera*) *tumida* A. AD., Thes. p. 573, pl. 125, f. 169.—*A. tumida* SOWB., Conch. Icon., f. 2.

The locality requires confirmation. Is it identical with *A. bicincta?*

A. TASMANICA Beddome. *Unfigured.*

Shell minute, thin, ovate, cylindrical, ventricose; whorls distinct, channelled at sutures, brown, with two white bands on body-whorl; aperture elongate, pyriform, rounded in front; columella excavated. Long. 2 mill., lat. 1 mill. (*B.*).

Off Old Station, Brown's River Road, 7 fms., *and Bruny Island, Tasmania.*

Akera tasmanica BEDDOME, Papers and Proc. Roy. Soc. Tasm., 1882, p. 169, 1883.

Genus CYLINDROBULLA Fischer, 1856.

Cylindrobulla FISCH., Journ. de Conch., 1856, p. 275, type *C. beaui.*

Shell thin and *fragile*, cylindrical, with sunken spire; aperture as long as the shell, *linear* except at base, produced at the vertex in a *deep slit following the suture* as in *Akera;* base obliquely truncated,

entirely open, *showing the whole interior of the body whorl* as well as the spirally ascending columella, when viewed from below. Type *C. beaui.*

Soft parts unknown. Differs from the allied genus *Volvatella* in the deep sutural slit and less inflated form.

Of the few species known, one is West Indian, one Mediterranean, the others from Ceylon, New Caledonia and Australia.

C. BEAUI Fischer. Pl. 42, figs. 19, 20.

Shell *very thin and fragile,* elastic, *cylindrical, abruptly and obliquely truncated below,* rounded above. Pale straw colored; surface smooth; spire sunken in an apical umbilicus the raised margin of which is formed partly by the erect inner lip continued backward over a half whorl, forming an inner edge to the sutural slit, and partly by the elevated angle of the whorl. Last whorl obliquely truncated below; *viewed from the base the whole interior of the spire and body whorl is visible.* Aperture as long as the shell, presenting a nearly round contour almost as large as a section of the cylinder when seen from the base; very narrow and linear above, and at the top curving backward and *extending in a narrow sutural slit two-thirds of a whorl in length.*

Alt. 9½, diam. 4⅔ mill.

Alt. 14, diam. 7 mill.

Gaudeloupe (Beau); *Smith's Bay, St. Thomas* (Mörch).

Cylindrobulla beaui Fischer, Journ. de Conchyl., 1856, p. 275, pl. 8, f. 8, 9.—Morch, Mal. Bl., xxii, p. 175.

C. FRAGILIS Jeffreys. Pl. 42, figs. 31, 32.

Shell cylindrical, very shining, hyaline; constricted and longitudinally striate at apex, elsewhere very smooth; spire loosely involute; vertex little conspicuous, obliquely attenuated. Aperture narrow above, dilated below and truncate. Alt. one-fifteenth, diam. one-thirtieth inch. (*Jeffr.*).

Off West Coast Italy 1521–1536 fms. ("Washington"); *Spezzia,* 10 fms. (Jeffr.); *Atlantic Coast of Spain* (McAndrew).

Cylichna fragilis Jeffr., Ann. Mag. Nat. Hist. (2), xvii, p. 188, pl. 2, f. 16, 17.—*Cylindrobulla fragilis* Jeffr., Ann. Mag. (5), x, p. 34.

The "Washington" specimens are adult; the largest is $\frac{1}{10}$ inch long. They are microscopically and regularly striated in a trans-

verse or spiral direction. I cannot agree with Messrs. Adams that Fischer's genus *Cylindrobulla* is the same as *Lophocercus*, nor with Monterosato in considering it a section of *Acera;* although the generic characters require some amendment. (*Jeffr.*).

C. FISCHERI Adams & Angas. *Unfigured.*

Shell cylindrical, fragile, thin, white, semipellucid, truncated in front, rounded and radiately striated behind, the striæ abruptly ceasing near the posterior end; aperture linear in the middle, nearly closed, dilated in front. Alt. 3, diam. 1½ lines. (*A. & A.*).

Spencer's Gulf, S. Australia (Angas); *Lane-Cove River, Port Jackson, N. S. Wales* (Braz.).

Cylindrobulla fischeri A. & A., P. Z. S. 1864, p. 37.—ANGAS, P. Z. S. 1865, p. 189, and 1871, p. 98.

This species differs from *C. beaui* Fisch., which is the only other described, and which inhabits Guadaloupe, in being white, in the spire being more conspicuous, and especially in the posterior extremity being strongly striate, the striæ ending abruptly at the distance of about a line from the suture. (*A. & A.*).

C. SOUVERBIEI Montrouzier. Pl. 48, figs. 9, 10.

Shell cylindrical, very thin, fragile, subtranslucid, very delicately striated; anteriorly obliquely truncated and broadly open, posteriorly roundly subacuminate; white under a very thin straw-colored epidermis; spire small, depressed; whorls 3 to 3½, separated by an incised suture; right margin acute, partly covering the last whorl from the front; columella spirally ascending, margined below by an inflated cord. Alt. 14, diam. 5½ mill. (*Sowb.*).

Island of Art, New Caledonian Archipelago.

Lophocercus (*Cylindrobulla*) *souverbiei* Montr. *in sched.* SOUVERBIE, Journ. de Conch. 1874, p. 195, pl. 7, f. 6.

Closely allied to *C. beaui*, but less obtuse above and more slender.

C. SCULPTA Nevill. Pl. 42, figs. 36, 37, 38.

Shell cylindrical, thin, white, narrowed in the middle, somewhat swollen behind, the suture deeply incised, truncated at the ends. Inner lip thickened; outer lip sinuous, inflexed. Aperture subdilated in front and rounded. Surface marked with minute flexuous growth striæ, which are stronger and straight behind. Alt. 6, diam 4 mill. (*Nev.*).

Ceylon.

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Cyl. sculpta G. & H. Nevill, Journ. Asiat. Soc. Beng. xxxviii, p. 68, pl. 13, f. 3, 1869.

This species is somewhat swollen toward the vertex and is marked above with rib-striæ, like *C. fischeri.*

C. pusilla Nevill. Pl. 42, figs. 24, 25, 26.

Shell elongate-cylindrical, somewhat swollen behind and truncate; white, shining, pellucid, very thin; with a narrow suture behind; lip inflexed. Aperture transversely subdilated, with thin margins; surface marked with minute striæ, closer behind. Alt. 4, diam. 2 mill. (*Nev.*).

Ceylon.

Cyl. pusilla G. & H. Nevill, *l. c.* p. 68, pl. 13, f. 2.

Rather closely allied to *C. beauii*, but differing in the overlapping of the outer lip, etc. There also appears to be considerable resemblance to a shell described by H. Pease as *Volvatella candida* (*Nev.*).

Genus VOLVATELLA Pease, 1860.

Volvatella Pse.. Proc. Zool. Soc. Lond. 1860, p. 20; Amer. Journ. Conch. iv, p. 73.

Shell thin and *fragile*, elastic, *swollen in the middle*, slightly narrower below, *abruptly contracted above the vertex into a short tubular open canal* formed by the raised continuation of the inner and outer lips. Spire sunken and concealed in an apical rimation. Aperture as long as the shell, roundly dilated and very effuse below, *the whole interior being visible from the base*, very narrow in the middle, *produced above the vertex in a spout-like channel.* Columella thin, spirally ascending. Type *V. fragilis.*

Animal completely retractile into the shell; head disk subquadrate, truncate and emarginate in front, strongly bilobed behind; eyes developed. Foot oblong, truncated in front, tapering behind. Epipodial lobes wanting; mantle small, included in the shell. Dentition unknown.

Distribution: Indo-Pacific. Living on sea-weed.

This group is apparently most closely allied to *Cylindrobulla*, differing only in the swollen form of the shell and its posterior "spout," which replaces the *Akera*-like slit of the other genus.

V. CINCTA Nevill. Pl. 42, figs. 33, 34, 35.

Shell ovate-cylindrical, membranaceous, involute, a little constricted in the middle, produced at both ends; abruptly contracted behind, gently rounded and somewhat dilated in front; Aperture extremely narrow behind, closed by the inflexion of the lip in the the middle, rounded below, the inner lip a little reflexed; outer lip thin, obliquely truncated above, sinuous in the middle; epidermis corneous, pale brown, with two wide reddish girdles; growth-striæ minute, regularly flexuous. Alt. 11½, diam. 6½ mill. (*Nev.*).

Ceylon.

V. cincta G. & H. NEV., Journ. Asiat. Soc. Beng. xxxviii, 1869, p. 67, pl. 13, f. 4.

Differing from its nearest ally, *V. vigourouxii*, in the peculiarity of the epidermis and in the anterior part of its aperture being more rounded and not nearly so dilated; there is also no callosity near the margin of the inner lip; the difference in size is equally very great, *V. vigourouxii* being 24 mill. in length and 14½ in breadth. The animal resembles that of *V. fragilis* Pease, the color being bright orange with bands of red aggregated corpuscles; it lives in shallow water on reefs among corallines, etc.; when molested exudes a milky fluid (*Nev.*).

V. VIGOUROUXI Montrouzier. Pl. 48, figs. 6.

Shell ovate, few-whorled, corneous, subpellucid, thin, membranous; rounded in front; subinflated and produced in a channel behind; whitish and spirally striated under the epidermis; spire concealed; inner lip produced in a channel behind; aperture rounded in front, narrowed and channelled behind, somewhat acute above. Alt. 24, diam. 14½ mill. (*Souv.*).

Balade, New Caledonia (Bordeaux Mus.).

Lophocercus vigourouxi Montr., in SOUV., Journ. de Conch. 1861, p. 271, pl. 11, f. 1.—*Volvatella vigourouxi* PSE., Amer. Journ. Conch. iv, p. 73.—FISCHER, Man. de Conch. p. 560, f. 319.—*Oxynoe vigourouxii* MORCH, Journ. de Conch. 1863, p. 47.

V. PYRIFORMIS Pease. Pl. 42, figs. 21, 22, 23.

Shell subobliquely cylindrical, thin, fragile, membranaceous; covered with a yellowish epidermis; longitudinally subflexuous-plicate; left side inflated; produced in a canal; aperture rounded in front (*Pse.*).

Animal uniform pale orange; as seen through the shell, freckled with red, which assumes transverse bands. Head subquadrate, slightly emarginate in front and provided with small lateral crests. Eyes black, inserted in a fissure on the side of the head. Foot oblong, truncated and widest in front, and gradually tapering to a rounded tip behind. Motions active; when disturbed discharging a viscid white fluid from the vent (*Pse.*).

Huahine.

V. pyriformis Pse., Amer. Journ. Conch. iv, p. 73, pl. 7, f. 5; pl. 12, f. 23.—*V. piriformis* Mts., Donum Bism., p. 54, pl. 2, f. 21.

Descriptions of the shells of this genus cannot be relied on for reason of the distorted change that takes place soon after they are removed from the animal and become dry. The shell resembles that of *Lophocercus vigourouxii* Montr. (*Pse.*).

V. fragilis Pease. Pl. 42, figs. 27, 28.

Shell thin, horny, subpyriform, convolute (finely striated longitudinally) covered with a membranaceous epidermis; spire none; aperture wide, dilated at the base and contracted posteriorly; the lips thin and entire, meeting at about one-half the length of the shell and folding closely one over the other, posteriorly produced in the form of a tube, leaving a circular aperture; color yellowish (*Pse.*).

Sandwich Is.

V. fragilis Pse., P. Z. S. 1860, p. 20; Amer. Journ. Conch. iv, p. 73, pl. 7, f. 4.

Animal: Mantel not exposed; cephalic disk quadrate, slightly in advance of the shell; tentacular lobes four, produced from the corners of cephalic disk, round, short and bluntly rounded at their extremities, anterior pair slightly longer; foot small, not extending posteriorly beyond the aperture, and not reaching in front the anterior side of the cephalic disc, of an oblong triangular shape, widest in front; eyes minute at inner base of posterior tentacles; anal opening at posterior aperture; color white. This anomalous animal was found on sea-weed dredged from a salt water pond. It remained alive several days in a glass jar; it was very timid and slow in its movements. The animal would occasionally protrude slightly from the posterior aperture (*Pse.*).

V. CANDIDA Pease. Pl. 42, figs. 29, 30; pl. 48, fig. 11.

Shell cylindrical, membranaceous, truncate posteriorly, much convolute, covered with a thin yellowish epidermis; aperture small, not one-half the length of the shell. Animal white, pellucid, neck long; head disk elongate, triangular, with a posterior fissure, Haminea-shaped, deeply fissured laterally. Foot oblong, rather wide anteriorly, rounded behind (*Pse.*).

Polynesia.

V. candida PSE., Amer. Journ. Conch. iv, p. 72, 160, pl. 7, f. 6; pl. 12, f. 24.

Resembles *Cylindrobulla beauii* Fischer (*P.*).

V. CUMINGI A. Adams. Pl. 48, fig. 7.

Shell subovate, gibbose, horny, fragile, pellucid, slightly involute; spire concealed; aperture posteriorly produced, narrow and linear, anteriorly greatly dilated; outer lip slightly sinuous, greatly inflected towards the body whorl, posteriorly produced; inner lip adhering, slightly reflexed (*Ad.*).

Puerto St. Elena, W. Columbia; sandy mud, 6 fathoms (Cuming).

Bulla (Lobiger) cumingii A. Ad., Thes. Conch. ii, p. 599, pl. 121, f. 58.—*Oxynoe cumingii* MORCH, Journ. de Conch. 1863, p. 47.—*Volvatella cumingi* FISCHER, Man. de Conch. p. 560.

Family *HYDATINIDÆ.*

Aplustridæ FISCHER, Man. de Conch. p. 560.

Shell globose or oval, thin, with exposed, nearly level spire of several whorls and minute, uptilted, nearly immersed nucleus. Last whorl very large, with conspicuously banded color-pattern. Aperture very large, the outer lip but little retreating toward its upper insertion, broadly rounded below, sometimes notched at base of the columella.

Animal voluminous, the foot large and flat; head disk bearing four or two tentacular processes in front, produced in two large lobes partly covering the shell behind. Radula lacking central teeth, the laterals numerous and all of the same form. Digestive tract very long.

The radula resembles that of *Akeridæ* except in lacking central teeth.

The present family differs from *Akeridæ* in the absence of the deep posterior bay or sinus of the aperture of the shell, and its con-

spicuous color pattern. The animal differs externally in the tentacular lobes of the head disk, which are like those of *Aplysia*, and totally unlike the simple head disk of *Akeridæ*.

Synopsis of Genera and Subgenera.

* Animal with four tentacles; shell without spiral sculpture.

Genus HYDATINA Schum.

Shell globose or oval, smooth, with narrow level or concave spire, the aperture broadly rounded below.

Subgenus APLUSTRUM Schum.

Shell obovate, with wide spire, the aperture deeply notched at base of the columella.

** Animal with two tentacles; shell more or less spirally striated.

Genus MICROMELO Pilsbry.

Shell globose-oval, with narrow spire, the aperture broadly rounded below; surface striate-punctate, decorated with spiral and wavy longitudinal lines.

Genus HYDATINA Schumacher, 1817.

Hydatina SCHUM., Essai d'un Nouv. Syst. pp. 57, 186, type *H. filosa* Schum.=*physis* L.—*Bullina* (in part) Férussac (see this vol. p. 175).

Shell globose or oval, thin, smooth, variegated, spirally banded; the spire exposed, either convex, flat or concave, apex a minute uptilted globose nucleus. Aperture about as long as the shell; outer lip not sinused behind, rather effuse or notched at base; columella straight or concave with reflexed edge. Type *H. physis.*

Animal capable of complete retraction, large; head disk bearing four tentacles like those of *Aplysia;* produced behind in two large lobes partly covering the shell, the eyes at their bases. Foot very broad, auriculate at the anterior angles, obtuse behind; epipodial lobes lacking; edges of the large foot reflexed over the shell (pl. 45, fig. 17, *H. physis*).

Radula with many longitudinal rows of similar teeth; centrals lacking; side teeth with denticulate cusps.

H. PHYSIS Linné. Pl. 45, figs. 14, 15, 16, 17.

Shell large, globose or oval, thin; under a thin buff cuticle the shell is white, *with many close wavy brown spiral lines.* Surface very slightly and coarsely waved longitudinally, otherwise smooth. Vertex flat, the spire about level; whorls about $3\frac{1}{2}$, the first a minute globose, uptilted and half immersed nucleus, the rest separated by deep sutures. Body-whorl globose above, somewhat attenuated below, where there is a convex spiral rib surrounding the umbilical tract; aperture about as long as the shell, large, ovate, narrower and curved above, dilated below. Lip simple and thin, very little retracted toward its upper insertion, rounded at base, bluntly angled at foot of the columella. Columella gently concave or nearly straight, with reflexed edge, leaving an umbilical chink or rarely none.

Alt. 32, diam. 29 mill., often larger.

Alt. 29, diam. 20 mill., slender specimen.

Natal (Krauss); *Mozambique and Imhambane* (Peters); *Mauritius* (Q. & G., Robillard, et al.); *Rodriguez* (Robillard); *Réunion* (Desh.); *Seychelles and Amirantes* (Dufo); *Red Sea* (Ehrenb., Cooke); *Philippines* (Martens); *Manila; Jeddo, Japan* (Lischke); *Port Jackson, Botany Bay and Moreton Bay, Australia* (Angas); *Sandwich Is.* (Newcomb); *Cuba* (Orbigny); *Guadeloupe* (Beau); *St. Thomas* (Swift); *St. Vincent Island, West Africa* (Geisse).

Bulla physis LINN., Syst. Nat. x, p. 727.—A. AD., Thes. p. 565, pl. 120, f. 9–11.—QUOY & GAIM., Astrol. p. 363, pl. 26, f. 1–3 (animal).—KRAUSS, Die Südafrik. Moll. p. 70.—*Hydatina physis* SOWB., Conch. Icon. f. 2.—DKR., Ind. Moll. Mar. Jap. p. 162.—MARTENS, Möbius' Reise p. 304; Monatsber. K. Akad. Wissensch. Berl. 1879, p. 738.—MKE., Mal. Bl. i, p. 41.—MORCH, Mal. Bl. xxii, p. 175.—COOKE, Ann. Mag. N. H. (5), xvii, p. 128.—LISCHKE, Jap. Meeres-Conch. i, p. 114.—ANGAS, P. Z. S. 1867, p. 225.—*Hydatina filosa* SCHUM., Essai d'un Nouv. Syst. p. 186.—*Bulla virgata* MARTYN, Univ. Conch. pl. 11.—*Bulla atrolineata* SCHROETER, Wiedemann's Archiv für Zool. u. Zoot. iv, p. 16.—*Bulla quoyana* ORB., Moll. Cuba, p. 131.—*Bulla* (*Hydatina*) *staminea* MKE., Zeitschr. f. Mal. 1853, p. 136; Mal. Bl. i, p. 41 (narrow form.)

Readily known by the numerous spiral lines. This species has an extremely wide range, surpassing, probably, any other Tecti-

branch. It inhabits the Indo-Pacific region, from Africa to Japan, Sandwich Is., and southeastern Australia, and reappears in the West Indies. I am unable to find any constant differences between oriental and occidental specimens.

The typical *physis* is quite globose. The following has been separated as a variety.

Var. STAMINEA Menke. Pl. 45, fig. 14.

Shell slenderer, oval, having oblique brown streaks. Occurs in both Indian Ocean and West Indies.

H. VELUM Gmelin. Pl. 44, figs. 7, 8, 9, 10.

Shell large, globose, thin; spire flat or sunken, the sutures deep; under a very thin pellucid epidermis the surface is whitish, streaked closely and longitudinally with light brown; middle with a narrow light girdle, bordered above and below with dark brown girdles; vertex with similar dark girdle, within which it is whiter; base defined by a fourth dark girdle; surface smooth; aperture ovate, narrowed and curved above, dilated below, well-rounded at base. Columella concave, reflexed over an open umbilical chink or closed. Alt. 40, diam. 35 mill.

Mauritius and Mozambique to Ceylon and East Indies.

Vexillum nigritarum, etc., CHEMN., Conch. Cab. x, pl. 146, f. 1348, 1349.—*Bulla vexillum* Chemn., A. AD., in Thes. Conch. ii, p. 565, pl. 12. f. 12–14; Voy. Samarang Moll. pl. 19, f. 4 (animal).—*Hydatina vexillum* SOWB., Conch. Icon. f. 4.—*Bulla velum* GMELIN, Syst. Nat. (13), p. 3433.—*Hydatina velum* MKE., Mal. Bl. i, p. 41.—DESH., An. s. Vert. vii, p. 670.—MARTENS, in Möbius' Reise, p. 304; Monatsber. K. Akad. Wissensch. Berl. 1879, p. 738.—*Bulla circulata* MARTYN, Univ. Conch. pl. 95; Chenu's reprint pl. 32, f. 3.—*Bulla cinctoria* PERRY, Conchology pl. 40, fig. 1.—*B. fasciata* BRUG., Ecycl. Méth. i, p.380.—EYD. & SOUL., Voy. de la Bonite, p. 462, pl. 25 (animal and anatomy).—*B. amplustra* BORN, Mus. Cæs. Vindob. p. 204, pl. 9, f. 1, not of Linné.

The color-pattern is a well marked and constant character of this species.

H. ALBOCINCTA Hoeven. Pl. 45, figs. 29, 30.

Shell large, thin, spire slightly concave; inflated, globose or oval; under a very thin pellucid epidermis it is closely and finely obliquely streaked with brown, interrupted by five wide, sharply

defined white girdles; one at vertex, one occupying the baso-umbilical tract, the others of equal width, equally spaced. Surface smooth; aperture ovate, narrowed and curved above, broadly rounded below. Columella concave, reflexed.

Alt 35, diam. 30 mill.

Alt. 36, diam. 26 mill.

Nagasaki, Japan (Birileff); *China* (Adams); *Philippines* (Jay); *Port Stephens, N. S. Wales, Australia* (Braz.).

Bulla albocincta Van der HOEVEN, Tydschrift voor natuurlyke Geschiedenis en Physiologie, Leyden, vi, 1839, p. 246, pl. 10.—AD., Thes. Conch., ii, p. 566, t. 120, f. 17, 18.—*Hydatina albocincta* SOWB., Conch. Icon., pl. 2, f. 3.—ANGAS, P. Z. S. 1877, p. 189.—LISCHKE, Jap. Meeres-Conch., ii, p. 105.—*Bulla ferruginosa* PERRY, Conchology, pl. 40, f. 2, 1811. Not *B. ferruginosa* Gmel.

As in the other species of *Hydatina*, the color-pattern is characteristic, consisting of white alternating with brown-streaked zones. The name given by Perry is preoccupied, and his figure is hardly recognizable.

H. INFLATA Dunker. Pl. 44, figs. 11, 12, 13.

Shell large, inflated and globose, *umbilicated*, rather thin, semipellucid; ashy and pale brown, very densely streaked longitudinally, and marked in the lower part by one white belt split by a brown line; a wide white band adjacent to the umbilicus; spire deeply immersed, milk-white within. Alt. and diam. 44 mill. (Dkr.).

Inland Sea of Japan, at Wakayama.

Hydatina inflata DKR., Malak. Bl. xxiv, p. 69, 1877; Index Moll. Mar. Jap., p. 162, pl. 2, f. 14–16.

Evidently allied to *H. albocincta*, but broader, with larger umbilicus, and lacking the broad white zones, which are here represented by one narrow girdle, and apical and umbilical patches.

Subgenus APLUSTRUM Schum., 1817.

Aplustrum SCHUM., Essai, pp. 63, 208, type *A. fasciatum* Schum. =*B. amplustre* Linn.—*Aplustra* SWAINS, Malacol. p. 248.—*Bullina* (in part) FERUSSAC (see ant., p. 175).

Shell obovate, thin, vividly banded, covered with a thick corneous cuticle. Columella truncated at base, the aperture notched there. Type *H. amplustre*.

Radula apparently lacking central teeth, the laterals all of the same form, stout thorn-shaped, the cusps not denticulate.

In the single species composing this group, the spiral basal funicle which is crescentic in *Hydatina physis*, is straightened and pressed against the columellar lip, and its termination below causes a distinct basal spout, which is only slightly indicated in the *Hydatina*. These differences seem, however, quite insufficient for generic separation.

H. AMPLUSTRE Linné. Pl. 44, figs. 1, 2, 3, 4, 5, 6.

Shell obovate, thin, wider above, tapering below; the spire wide, convex; whorls about 5, the first a minute uptilted, partly immersed nucleus, the following whorls planorboid with impressed suture, the last whorl slowly descending, wide above, tapering below. Under a strong brown epidermis it is crimson or pink, with a broad subsutural white zone bordered outside by a black band; a median white zone bordered above and below by black bands (rarely coalescent across it), and a white umbilical tract bounded above by a black band. Aperture nearly three times as long as wide, not sinused above, broadly channelled at base. Outer lip thin, its profile nearly straight, retracted at base. Columella a large subvertical pillar, truncated at base, its inner edge covered with a thin, nonadherent callus. Alt. 25, diam. 19 mill.

Bramble Cay, outer Great Barrier Reef, Northeastern Australia; Aneiteum, New Hebrides, New Caledonia (Brazier); *Upolu, Rarotonga* (Garrett); *Sandwich Is.* (Newcomb, Townsend et al.); *Réunion* (Desh., et al.); *Mauritius* (Lienard, et al.); *and I. Fouquets* (Möbius); *Mahé, Seychelles* (Dufo).

Bulla amplustre LINNE, Syst. Nat. x, p. 727; xii, p. 1184.—HANLEY, Ipsa L. Conch., p. 206.—WOOD, Index Testac., pl. 18, f. 26.—*Bulla amplustra* GMEL., p. 3426.—*Bulla aplustre* LAM., Anim. s. Vert., vi, pt. 2, p. 35.—QUOY & GAIM., Voy. Astrol., ii, p. 366, pl. 26, f. 4–7 (living animal).—EYDOUX & SOULEYET, Voy. de la Bonite, pl. 25, f. 14–17 (living animal).—*Aplustrum amplustre* L., MORCH, Catal. Yoldi, p. 137.—H. & A. AD., Gen. Rec. Moll., ii, p. 7, pl. 56, f. 3.—CHENU, Manuel, i, p. 286, f. 2905.—*Hydatina aplustre* MARTENS, Möbius' Reise nach Mauritius, p. 304; Donum Bism., p. 51.—*Aplustrum fasciatum* SCHUM., Essai, etc., p. 208, (1817).—*Aplustra pulchella* SWAINS. Malacol., p. 248, (1840).—*Amplustre thalassiarchi* MARTINI, Naturlexicon, i, p. 383, pl. 18, f.

10.—*B.* (*A.*) *thalassiarchi* Ad. in Thes. ii, p. 564, pl. 120, f. 4–6.—*Aplustrum thalassiarchi* Sowb., Conch. Icon., xvi, f. 2.—Brazier, Proc. Linn. Soc. N. S. Wales, ii, p. 79.

The near alliance of this species to the *Hydatinas* is shown in the convex columellar rib which forms the basal spout, as in *H. physis*, and the pattern (but not color) of the markings, which is exactly as in *H. velum*. There can be no doubt of the localities given above, as the extreme eastern and western limits are attested by many excellent authorities, and are represented by many specimens before me.

The shell, when fresh, is covered by a thick brown cuticle, which projects at the lip well beyond the calcareous layer. The black bands are reduced to narrow lines in one lot of about 50 specimens from the Sandwich Is., in the Academy collection; one of these being represented in fig. 6, but some others have them still narrower and fainter.

This species has appeared in the books under many names, but by the nature of things none can antedate *amplustre* of Linnæus' tenth edition of the Systema.

Genus MICROMELO Pilsbry, 1894.

Bullina Fer. in part (see ant., p. 175).—*Hydatina* Auct. in part.—*Bullinula* Gray, not Swains.

Shell oval, rather thin, with exposed nearly flat spire of several whorls and minute, uptilted, subimmersed nucleus. Last whorl large spirally striate-punctate, with a color-pattern of two or three spiral and many wavy longitudinal lines. Aperture pear-shaped, dilated and rounded below; outer lip a little notched at suture; columella concave, with reflexed edge, obscurely folded above. Type *M. undata* Brug.

Animal not completely retractile into the shell; head disc bearing two flat tentacular processes in front, produced behind in two large lobes partly covering the shell. Eyes wanting? Foot large; stomach without bony plates; dentition unknown (pl. 59, fig. 26, *M. guamense*).

This genus differs from *Hydatina* and *Aplustrum* in the spirally sculptured shell, the animal having two, instead of four tentacular processes on the head disk. I have not followed Fischer in considering *B. undata* Brug. the type of *Bullina* Fér. because Férussac

calls the species "*undulata* Brug.," and because the shell he meant was not the species of Bruguière. Neither have I followed v. Martens in giving *B. guamense* as the type of Férussac's group, because Férussac did not mention that species, and the identification of his "*B. undulata* Brug." with *guamense* is only hypothetical, although extremely probable. Surely if such an identification be sufficient to fix the identity of the *genus*, it is enough to fix that of the *species;* and v. Martens does not go so far as to call *guamense* "*undulata* Fér.," as he would be compelled to do were his view followed to its logical conclusion.

M. UNDATA Bruguière. Pl. 59, figs. 20, 21, 22, 23, 24.

Shell oval, rather thin, white with two or three equidistant spiral red lines and many deeply sinuous longitudinal red lines. Surface shining, showing under a lens many unequally spaced spirals composed of rounded pits just touching each other; this sculpture often nearly obsolete and hardly visible except at the base. Vertex rather narrow, the spire nearly level; first whorl a shining, uptilted, nearly immersed nucleus; following whorls separated by impressed sutures. Aperture long, pear-shaped, gradually narrowed and curved to the left above, broadly rounded below; lip receding a trifle at suture. Columella broadly concave, with reflexed, appressed edge. Alt. 12½, diam. 8½ mill.

St. Thomas (Swift, Krebs, et al.); *St. Vincent* (Guilding); *St. Martin* (Krebs); *Cuba* (Sagra).

Bulla undata BRUG., Encycl. Méth., i p. 380.—ORB., Moll. Cuba i, p. 132.—*Bullina undata* MORCH, Mal. Bl. xxii, p. 174.—*Bulla nitidula* (Solander, MSS., Portland Catal., undesc.) DILLWYN, Descript. Catal. Recent Shells, i, p. 483.—A. AD., Thes. Conch., ii, p. 565, pl. 120, f. 15, 16.—*Hydatina nitidula* SOWB., C. Icon., f. 1 (false locality.)—*Bullina elegans* MKE., Syn. Meth. Moll. Mus. Menkeano, edit. 2, 1830, p. 13 (founded upon Lister's figures).

The spiral red lines often occupy the middle of an ill-defined reddish band, and frequently the median line is wanting.

M. GUAMENSIS Quoy & Gaimard. Pl. 59, figs. 25, 26.

Shell ovate, pellucid, grooved by several black undulating longitudinal lines and three transverse lines. It is covered by a thin extended epidermis, and is wider in front than behind. The obtuse re-entrant spire describes a little more than two whorls; the ground

is white, translucent, traversed by three well-defined narrow black lines, which are equally spaced and a little obliquely transverse. At right angles with these are about 10 longitudinal strongly and irregularly waved lines of the same color. Length 5, breadth 3 lines.

Agagna, Island of Guam. Marianne group (Freycinet); *Hilo, Sandwich Is.* (Garrett); *Mauritius* (Lienard); *Réunion* (Dh.) *and Fouquets* (Möbius).

Bullœa guamensis (*Bullée Férussac*, on plate) Q. & G., Voy. l'Uranie et la Physicienne, Zool., p. 423, pl. 66, f. 10, 11, 12 (1824). —*Hydatina guamensis* Pse., Amer. Jour. Conch., iv, p. 132.—Martens & Langk., Donum Bism., p. 52.—*Bulla scripta* Garrett, Proc. Cal. Acad. Sci., i, 1857, p. 103.—*? Bullina undulata* Brug., Ferussac, Tab. Syst., p. xxx (no description).—*Bullinula undata* Quoy, Gray, Figs. Moll. Anim., iv, p. 96, 1850; i, pl. 59, f. 6 (copied from Quoy).—*Bulla ferussaci* Desh. in Lam., An. s. Vert. vii, p. 57.—Catlow & Rve., Conch. Nomencl., p. 113, 1845.

Very similar to the West Indian *M. undata*, but slenderer, alt. 9, diam. 6 mill., and the markings black, not red; spiral striation very weak, generally distinct only on the base.

M. eximia Deshayes. Pl. 59, figs. 18, 19.

Shell ovate-oblong, subcylindrical, thin, pellucid, whitish-roseate, peculiarly ornamented with blackish-brown longitudinal wavy hair lines, and two distant transverse interrupted lines; spire very short, obtuse; whorls 3, narrow, joined by a linear suture, the last whorl large, smooth in the middle, obsoletely striated in front; aperture large, dilated in the front part, narrower and subemarginate behind; columella thin, white, deeply arcuate. Alt. 13, greater diam. 11, lesser 7 mill. (*Dh.*).

Réunion; Mauritius.

Bulla eximia Dh., Moll. Réun., p. 55, pl. 7, f. 23, 24 (1863).—Lienard, Cat. Faun. Mal. Maurice, p. 53.—*Hydatina eximia* Martens, Möbius' Reise n. Maurit., p. 304.

This form is probably a variety or synonym of *guamensis*.

Family *RINGICULIDÆ* Meek.

Ringiculinæ Meek, Amer. Journ. Sci., 2, xxxv, pp. 87, 92, (1862). —*Ringiculidæ* Meek, Check-list Inv. Foss. N. A. Cret., pp. 16, 34,

1864.—Gill, Smiths. Misc. Coll., No. 227, p. 14.—Fischer, Man. de Conch., p. 561.

Shell short and ventricose, with conic spire of several whorls; aperture narrow, obstructed by folds on the columellar margin; peristome thickened outside, often dentate within. Operculum wanting.

Animal completely retractile within the shell, with short foot, head-disc wide, prolonged backward in the middle, a sort of siphon being formed by the rolled-in margins; radula without central tooth, laterals two, arcuate, the cusps directed inwards. (See pl. 46, fig. 49).

In the recent fauna this family is represented by but one genus, *Ringicula*. There are several fossil groups, *Avellana*, *Cinulia*, *Oligoptycha*, etc. (See Struct. and Syst. Conch.).

Genus RINGICULA Deshayes, 1838.

Ringicula Dh., Hist. Nat. Anim. s. Vert., 2d edit.. viii, p. 323, 1838, type *Auricula ringens* Lam.—Morlet, Journ. de Conchyliologie 1878, pp. 113, 251; 1880, p. 150; 1882, p. 200 (illustrated monograph of recent and fossil species).—*Ringiculina* Monterosato, Nom. Gen. e Spec., p. 141, type *R. leptocheila* (1884).

Shell small, solid, nearly white, ovate-globose, the spire conical; aperture from one-half to three-fourths the shell's length, conspicuously notched and channelled at base; outer lip thickened and often dentate or crenulated within, margined with callus outside; columellar margin heavily calloused, with two to four strong entering folds. Type *R. ringens* Lam.

Jaws as in *Akera*, etc.

The animal is peculiar in the very broad head-disk produced in a sort of siphon in the middle behind. The dentition closely resembles that of *Philine* and the *Scaphandridæ*.

Ringicula ranges over nearly all tropical and subtropical seas. In the geological series it extends to the base of the Eocene with a few forms in the Cretaceous, but below the Tertiary the group is represented mainly by *Cinulia* and *Avellana*. About 42 recent and 75 fossil species have been described.

Morlet divides the group as follows; the fossil species are not here enumerated:

1st Group, lip denticulate (*Ringicula s. str.*), contains *R. caron, denticulata, encarpoferens.*

2d Group, lip not denticulate.

a. Columellar margin with two folds (*Ringiculina* Monts.), *R. leptocheila, nitida, peracuta, pusilla.*

b. Columella with three folds, all species not named above and below.

c. Columella with four folds, *R. conformis, salleana.*

The larger part of the modern representatives of this genus belong to the section with non-crenulated lip and 3-plicate columella; they form a group of very closely allied species, many of which can be identified only with great difficulty, unless authentically named specimens are at hand for comparison. The group has been monographically studied by Commandant L. Morlet; and from his work a large part of the following account has been taken.

Mediterranean, North Atlantic and West Indian Species.

R. buccinea Brocchi. Pl. 46, fig. 51.

Shell minute, subovate, inflated, smooth; spire short, acute; columella triplicate, the folds acute, lip expanded, adnate; outer lip margined, inflated in the middle, not grooved. (*Brocchi*).

Alt. 4·8, diam. 4 mill.

West coast of France and Spain; Mediterranean.

Voluta buccinea Brocchi, Conch. Foss. Subap. ii, p. 645, pl. 4, f. 9, 1814.—*Auricula buccinea* Sowb., Min. Conch. v, p. 100, pl. 465, f. 2.—*R. buccinea* Desh., An. s. Vert. viii, p. 344.—Morlet, Journ. de Conch. 1878, p. 132, pl. 5, f. 16; p. 278, pl. 8, f. 6 (fossil).

Quite closely allied to *R. auriculata*, but more globose, with shorter spire, heavier callus, the surface always smooth and shining. (*Morl.*).

It occurs also in the middle and upper Miocene and lower Pliocene.

R. auriculata Ménard. Pl. 46, figs. 49, 50.

Shell minute, ovate, inflated, white, smooth; spire short, acute; base emarginate; columella triplicate, the folds acute; lip expanded adnate; lip margined, callous. Alt. 5·1, diam. 4 mill. (*Mén.*).

Ocean coast of Spain; Mediterranean; Madeira.

Marginella auriculata MENARD, Ann. du Mus. xvii, p. 331, 1811. —PHIL., Enum. Moll. Sicil. i, p. 231.—*Ringicula auriculata* PHIL., *loc. cit.* ii, p. 198, pl. 28, f. 13.—MORLET, Journ. de Conch. 1878, p. 130, pl. 5, f. 14.—WATSON, *tom. cit.*, p. 312, pl. 10, f. 4 (living animal).—JEFFREYS, Ann. Mag. N. H. (4), vii, p. 245.—SEGUENZA, Atti Accad. dei Lincei, Mem. ix, p. 344, figs.

Very closely allied to *R. buccinea*, but distinguished by the less globose form, longer spire, weaker callous and revolving striæ.

R. CONFORMIS Monterosato. Pl. 46, figs. 33, 34.

Differs from *auriculata* in the form and arrangement of the teeth; the aperture is more ringent, and the surface is not spirally striate. In some localities this species presents an appearance of vertical folds on the earlier whorls. (*Monts.*).

Alt. 4, diam. 3·4 mill.

Mediterranean, deep water (Monts.); *Cape Breton* (Folin).

R. auriculata var. conformis MONTS., Nuova Révista Conch. Medit. p. 45, 1875.—*R. conformis* MONTS., Journ. de Conchyl. 1877, p. 44, pl. 11, f. 4.—MORLET, *l. c.* 1878, p. 131, pl. 5, f. 15.—SEGUENZA, Atti della R. Accad. dei Lincei, Memorie, ix, p. 344–390, figs.

R. TERQUEMI Morlet. Pl. 46, figs. 41, 42.

Shell small, globose, thin, regularly striate, the striæ conspicuous on the apertural face of the last whorl, sometimes obsolete on its back, 3 to 8, three of which are basal; whorls 4½, globose, separated by a channelled suture; last whorl over half the length of the shell, rounded at base; spire short, rapidly increasing; aperture wide, the margins joined by a thin callus, columellar margin arcuate below, triplicate, the folds thick, short; upper fold like a twisted callous, lower fold larger than the middle one; lip regularly arcuate, slightly calloused and subdentate in the middle, a little prominent outside. Alt. 3, diam. 1½ mill. (*Morl.*).

Bay of Smyrna, in 20 meters (Terquem).

R. terquemi MORL., J. de C., 1880, p. 159, pl. 5, f. 7.

R. SCHLUMBERGERI Morlet. Pl. 46, figs. 53, 54.

Shell short, globulose, thick; whorls 5, convex, separated by an impressed suture, ornamented with deep, regularly distant spiral striæ, conspicuous on the latter three-fourths of the last whorl;

penultimate longitudinally costellate; last whorl two-thirds the total length, rounded at base; spire short; aperture constricted, margins joined by a thick callus, with the lip forming a canal; columellar margin arcuate, quadri-plicate, the upper fold delicate, lower two delicate, contorted, horizontal; lip arcuate, thick, provided in the middle with a tooth-like tubercle, more or less prominent.

Alt. 4, diam. 3 mill. (*Morl.*).

Mediterranean.

R. schlumbergeri Morl., J. de C., 1878, p. 204, pl. 9, f. 4.

Cannot be confounded with any of its congenors on account of the short form, the ornamentation consisting of striæ and ribs crossing them, and the fourth fold of the interior.

R. admirabilis Morlet. Pl. 46, figs. 45, 46.

Shell globose, thick, delicately striate and costellate, (transverse striæ 3–4 on upper whorls, numerous and dense on last whorl; costellæ less conspicuous on back of the last whorl); whorls 5½, slightly convex, separated by an impressed suture, the last whorl three-fifths the total length, rounded at base; aperture constricted, the margins joined by a thick callus; columellar margin quadriplicate, the upper two folds thick, short, the third fold short, contorted, the lower fold delicate and horizontal; lip little arcuate, thickened in the middle and reflexed outside. Alt. 3·5, diam. 2·5 mill. (*Morl.*).

Mediterranean.

R. admirabilis Morl., Journ. de Conch. 1882, p. 203, pl. 9, f. 3.

Approaches in its striation the miocene and pliocene *R. elegans* Pecchioli but it is longer, more finely and closely striate, and the lowest fold is horizontal.

R. abyssorum Morlet. *Unfigured.*

Shell thin, globulose, of large size, ornamented with transverse striæ and very fine and close longitudinal ribs; the lip peculiar in form. (*Morl.*).

Mediterranean? (Second Exped. Travailleur, 1881).

R. abyssorum Morl., Journ. de Conch. 1882, p. 206.

R. salleana Morlet.

Shell small, short, ventricose, thick, shining, ornamented with regular, deep spiral striæ; whorls 6, convex, separated by a linear

suture, the last whorl four-fifths the length of the shell, rounded at base; spire very short; aperture narrow, margins joined by a thick callus; right margin forming a canal above; columellar margin arcuate, with four folds, the upper two folds thick, short, obliquely directed downward, lower two folds transverse; lip arcuate, thick within especially at base, narrower above, varicose outside and covering three-fourths of the penultimate whorl. Alt. 5·2, diam. 4·5 mill. (*Morl.*).

Off Cape Breton (Folin).

R. salleana Morl., J. de C., 1880, p. 153.

Characterized by the very globular, short form, the four folds of the columellar margin, thickness of the columellar callus bordered by a distinct groove.

R. passieri Morlet. Pl. 46, figs. 39, 40.

Shell subventricose, thick, subelongate, regularly striated, the striæ impressed, transverse, distant; whorls 7 to 7½, convex, separated by a linear, margined suture; last whorl two-thirds the total length, rounded at base; spire elongated; aperture narrow above, dilated below, margins joined by a callus; columellar margin arcuate triplicate; upper fold vertical, lower sinuous; lip thick, prominent outside, a little sinuous within, rounded below; above partly covering the penultimate whorl and forming a canal. Alt. 5½, diam. 3½ mill. (*Morl.*).

Off Cape Breton (Folin).

R. passieri Morl., J. de C., 1880, p. 157, pl. 5, f. 5.—Folin, Les Fonds de la Mer. iii, p. 334.

R. pulchella (Jeffreys) Morlet. Pl. 46, figs. 35, 36.

Shell small, thin, more or less elongate; whorls 5, convex, separated by a deep suture, rather smooth, delicately sulcate above; last whorl two-thirds the total length, ornamented with two spiral lines above near the suture, then smooth, transversely punctate-lirate in the middle and below, the base rounded; aperture ample, margins joined by a thin callus; columellar margin slightly arcuate, three-folded, the folds minute; lip regularly arcuate, thin, slightly prominent outside. Alt. 3·2, diam. 2 mill. (*Morl.*).

West of Ireland, in 1180–1215 fms.; *between Falmouth and Gibraltar*, 227–795 fms. (Porcupine).

R. pulchella Jeffr., Morl., J. de C., 1880, p. 158, pl. 5, f. 6.

R. SEMISTRIATA Orbigny. Pl. 46, figs. 43, 44.

Shell ovate-conic, thick, whitish, smooth posteriorly, transversely striated in front; spire acute, conic, suture impressed; aperture oblong, columella thickened, biplicate, with a spreading posterior callus; lip very thick, subtuberculate in the middle. Alt. 2, diam. 1 mill. (*Orb.*).

Jamaica (Candé).

R. semistriata ORB., Moll. Cuba, ii, p. 103, pl. 21, f. 17–19.

R. NITIDA Verrill. Pl. 46, fig. 38.

Shell small, white, smooth, broad oval, with five whorls, spire rapidly and regularly tapered, sub-acute, shorter than the aperture. Whorls very convex, regularly rounded, the sutures well impressed; a well marked, impressed, revolving line just below the suture; the surface otherwise nearly smooth, but with more or less distinct, distant, microscopic revolving lines, most distinct anteriorly. Aperture somewhat crescent-shaped. Outer lip evenly rounded, forming the segment of a circle, the border regularly thickened, receeding a little posteriorly, near the suture. Callus on the body-whorl narrow, nearly even, but a little swollen in the middle and slightly raised. Columella stout, recurved at the end, with two strong, very prominent, equal, spiral folds—the anterior one projecting beyond the canal, with the end rounded. Length, 4·2 mill.; breadth, 3·1 mill.; length of aperture, 2·5 mill.; breadth of aperture, 11 mill. (*V.*).

Mediterranean in deep water (Monts.); *Ocean coast of Spain and France, and North Atlantic* (Jeffr. and Folin); *Bed of Gulf Stream*, 447 fms. (Pourtales); *Yucatan Strait, off Tortugas, off Martinique, off Grenada* (Blake); *Pliocene of Italy.*

R. nitida VERRILL, Amer. Jour. Sci. (3), v. p. 16, Jan. 1873 (extra copies issued Dec. 13, 1872); Trans. Conn. Acad. iii, p. 48, pl. 1, f. 2; *l. c.* v, p. 540.—DALL, Bull. M. C. Z. ix, p. 97; xviii (Blake Gastrop.) p. 43.—*R. leptocheila* BRUGNONE, Misc. Malac. p. 11, pl. 1, f. 17, 1873.—AGASSIZ, Three Cruises of the Blake, ii, p. 70 f. 291.—MONTS., Nuova Rivista Conch. Med., p. 45; Journ de Conch., 1874, p. 279.—MORLET, Journ. de Conch., 1878, p. 131, 285, pl. 5, f. 17.—SEGUENZA, Atti R. Accad. dei Lincei, Mem., ix, p. 344, et seq., figs.

The synonymous *R. leptocheila* is shown in fig. 31, pl. 46.

Dall writes: I have satisfied myself by a comparison of authentic specimens, that the species of Verrill and Brugnone are the same,

the former name having priority. The locality, description and figure of *R. peracuta* agree well with the varieties of *R. nitida*, with which it does not seem to have been compared. The elevation and the extent of the spiral grooving differ in different individuals, as observed with species of *Actæon*.

R. PERACUTA Watson. Pl. 46, fig. 37.

Shell ovate, with a somewhat high conical small-pointed spire, smooth and glossy, spirally furrowed below the periphery, with a marginated suture and a largish mouth. Sculpture: Longitudinals —the whole surface is pretty regularly scored with distinct, but not sharp, shallow furrows on the lines of growth. Spirals—just below the suture is a fine furrow fictitiously strengthened by the the shining through of the superior whorl; from the periphery to the point of the base there are rather remote spiral furrows which seem to vary as usual in number and in distinctness. Color, glossy white, with a faint bluish tinge. Spire rather high, conical, scarcely subscaler. Apex sharp, for though the extreme tip is a little tumid, it stands well up and is rounded. Whorls 5, conical, slightly convex; the last is a little tumid above, but a little way behind the outer lip is somewhat contracted and flattened. Suture distinct. Mouth rather large, not very oblique. Outer lip very oblique to the axis of the shell, slightly thickened, toothed and prominent in the middle, with large open sinus above and a very slight one in front. Inner lip: there is a rather slight callus with a small tooth about the middle: the pillar teeth, which are very far from parallel, are nearly equal. Alt. 0·18 in., diam. 0·1. Mouth, height, 0·1; breadth, 0·07 inch (*Wats.*).

North of Culebra Island, 390 fms.; *off Bermudas*, 1075 fms; *off Pernambuco*, 350 fms. (Challenger).

R. peracuta WATS., Chall. Gastr., p. 636, pl. 47, f. 11. *Conf.* DALL, Blake Gastrop., p. 44.

Dall considers this a form of *R. nitida*.

Ringicula grandinosa Hinds., from the West African coast, is not unlike this species, but is smaller; the body-whorl in particular is much smaller, while the penultimate is larger; it is without sculpture on the base, and the upper whorls are strongly spiralled. *Ringicula acuta* Phil., from the Red Sea, is smaller, with a less swollen body-whorl and more tumid base, the whorls of the spire are less tumid and less exserted. *Ringicula someri* De Folin, from the

Cape Verde Islands, which is like in general aspect, is a much smaller, thicker and more spiralled shell, with a less tumid body-whorl and more regularly conical spire, the slope of the whorls being more flattened; the apex, too, is much finer. *Ringicula semistriata* d'Orb., from Cuba, is shorter, broader, and less spiralled. *Ringicula auriculata* Ménard, which is, perhaps, as like as any, has not the contracted base, and its extreme tip is 0·004 in. broad, while here the tip is 0·008 in., or twice as much. I have called this species peracuta, because, though certainly not very sharp, it is much more so than *Ringicula acuta* Phil. (*Wats.*).

R. CABRAI Morlet. Pl. 46, figs. 47, 48.

Shell very minute, subventricose, thick; whorls 4½, slightly convex, separated by a channelled suture, ornamented with deep spiral sulci; sometimes with a groove above and several on the base, sometimes with equally spaced grooves over the whole surface; last whorl three-fifths the total length. Aperture large, the margins joined by a thick callus; columella margin strongly arcuate, bearing three minute folds, the upper folds very thick, lower folds delicate and horizontal; lip arcuate, thick, prominent outwardly, inside with a flat median callus and a small tooth below. Alt. 2·5, diam. 1·8 mill. (*Morl.*).

Island of St. Martha, Columbia.

R. cabrai MORL., Journ. de Conch., 1882, pp. 201, 326, pl. 9, f. 1.

Resembles *R. goujoni* in the lower lip-tooth, but is smaller, with another style of sculpture and with heavier callus and stronger teeth.

West African species.

R. SUTURALIS Smith. Pl. 46, fig. 57.

Shell ovate, white, polished; spire acuminate, suture encircled by a callus cord; whorls 5, convex, spirally sulcate; last whorl having 10 sulci. Aperture pyriform; columella callous, triplicate; lip strongly calloused outside. Alt. 2¾, diam. nearly 2 mill. (*S.*).

Whydah, W. Africa.

R. suturalis E. A. S., P. Z. S., 1871, p. 733, pl. 75, f. 12.

This minute species belongs to the same striated group as *R. propinquans* Hinds, from the Philippines and *R. someri* De Folin, from the Cape Verde Islands. Its much smaller size, the number and position of the teeth, and the callous chord around the suture of the whorls well distinguish it (*S.*).

R. SOMERI Folin. Pl. 46, figs. 52, 58.

Shell small, ovate-globose, thick, solid, white, transversely minutely and regularly sulcate; whorls 6 to 7, subcarinate, the earlier rapidly increasing, last very large, globose seven-tenths the shell's length; suture simple; aperture elongated, oblique, the margins strongly thickened, toothed; right margin very wide, the left inflated, broadly reflexed; teeth large. Alt. 4, diam. 2·6 mill. (*Folin*).

Strait of St. Vincent, Cape Verde Is.

R. someri FOLIN, Les Fonds, i, pt. 1, pl. 14, pl. 1, f. 7.—MORL., Journ. de Conch., 1878, p. 128, pl. 5, f. 12.

R. MORITZI Folin. Pl. 46, fig. 32.

Shell ovate-globose, somewhat glassy, generally much thickened and snow-white, spirally and regularly sulcate, the sulci minute, often vanishing; whorls 4, rapidly increasing, the last very large: globose, half the length of the shell; suture simple; aperture semilunar; left margin thickened, terminating in a rounded canal; right margin strongly reflexed above the base, inflated, toothed, teeth 3; the margins joining above in a rather deep canal. Alt. 2·5, diam. 1·5 mill. (*Folin.*)

Cagnabac, East coast of Africa.

R. moritzi FOLIN, Les Fonds, i, pt. 2, p. 212, pl. 26, f. 10.—MORL., Journ. de Conch., 1878, p. 129, pl. 5, f. 13.

Smaller than *R. someri* with fewer whorls, wider and less rounded basal canal, and thinner callus on the inner lip.

R. SENEGALENSIS Morlet. Pl. 46, figs. 55, 56.

Shell small, globulose, short, thick; whorls 5, convex, separated by a deep suture; the earlier whorls striulate, last whorl radially costellate, except on the back, two-thirds the entire length, rounded at base. Aperture coarctate, margins joined by a thick callus, the callus occupying the base; columella triplicate, the upper fold strong, dilated at base, forming a canal above, median fold short, lower fold delicate, contorted; lip little arcuate, thick, provided with a long median callous subdentate at the ends. Alt. 3, diam. 2·3 mill. (*Morl.*).

Coast of Senegal, in 72 meters (Schlumberger).

R. senegalensis MORL., Journ. de Conch., 1882, p. 202, pl. 9, f. 2.

Distinguished by its very globose form, its striation, and especially the projecting callus of the lip.

R. BOURGUIGNATI Rochebrune. *Unfigured.*

Shell thick, subglobose, smooth, pale greenish, the spire acute; whorls 5, convex, separated by deep sutures; aperture elongate, the columellar margin calloused, tridentate, narrower in the middle; lip thick, biplicate. Alt. 5, diam. 2½ mill. (*R.*).

Mouth of the Casamence, Senegambia, 150 meters.

R. bourguignati ROCHEBR., Bull. Soc. Philomath. de Paris (7), vii, 1882–1883, p. 178 (1883).

Indo-Pacific Species.

R. DOLIARIS Gould. Pl. 47, figs. 82, 83.

Shell large, thin, ventricose, ovate, whitish; spire acuminate; whorls 4, rounded, engraved with remote transverse sulci, the last whorl ample; suture profound; aperture large; lip narrow, scarcely thickened; columellar folds delicate, acute; parietal fold small, delicate; siphonal canal moderate. Alt. 5, diam. 3+mill. (*Gld.*).

Hakodate Bay, Japan, 6 fms. (Stimpson).

R. doliaris GLD., Proc. Bost. Soc. N. H., vii, p. 325; Otia, p. 121. —MORL., Journ. de Conch., 1878, p. 126.—WATSON, Challenger Gastrop. p. 634, pl. 47, f. 8.

Peculiar from its thin lip and general want of callus (*Gld.*).

The figures are drawn from specimens identified as *doliaris* by Watson, collected at Port Jackson, Australia, by the "Challenger." Watson says of them: "Gould observes that this species is peculiar from its thin lip and general want of callus. The Challenger shells are somewhat less tumid than the British Museum specimens, want the round swollen shoulder below the suture, the upper whorls, too, are flatter, and the spire is rather higher; in all these respects, however, the species presents considerable range of variation, and, I believe, may fairly admit the Challenger specimens. The Marquis de Folin, who has a large acquaintance with this genus, kindly examined all the Challenger specimens for me, and I regret that he does not share my opinion regarding the shells under consideration here, which he holds to represent a new species."

R. ARCTATA Gould. Pl. 47, figs. 74, 75, 79.

Shell solid, ovate, acuminate, white; whorls of the spire 4, convex, the last engraved with 10–12 spiral striæ; suture profound; aperture ear-shaped, the lip thickened, swollen within, with folds on

the columella; parietal tooth robust, continued as far as the posterior angle of the aperture; labial callus wide, passing into the siphonal sinus. Alt. 4, diam. 4 mill. (*Gld.*).

Hong Kong (Gld.); *Nagasaki* (Lischke); *Goat Island, Port Jackson and Cape York, N. Australia* (Brazier).

R. arctata Gld., Proc. Bost. Soc. N. H., vii, p. 325; Otia Conch., p. 122. Angas, P. Z. S., 1871, p. 98.—Lischke, Jap. Meeres-Conch., ii, p. 78, pl. 5, f. 16, 17; iii, p. 59.—Morl., Journ. de Conch., 1878, p. 124, pl. 5, f. 9.—Brazier, P. L. S. N. S. W., ii p. 78.

Allied to *R. caron* and *propinquans*, but the spiral lines are closer. The Australian localities are open to doubt until specimens have been compared with the types.

R. œhlertiana Morlet. Pl. 47, figs. 77, 78.

Shell small, thin, globose, regularly and delicately striate; whorls 4½ to 5. convex, separated by a subcanaliculate suture; spire short, acute, subgradate; aperture wide, the margins joined by a callus, reaching up to the middle of the penultimate whorl; columellar margin arcuate, triplicate, the upper fold short, vertical, and forming a right angle with the callus; lower folds delicate, ascending, contorted; columella granose-roughened at base; lip little arcuate, subprominent in the middle, channelled above, thickened outside.

Alt. 4·2, diam. 3·6 mill. (*Morl.*).

China Sea (Morlet); *Seas of Japan*, 30–54 fms. (St. John).

R. œlertiana Morl., J. de C., 1880, p. 156, pl. 5, f. 4.

Allied to *R. canaliculata*, but differs in its thinner, more twisted folds, thinner lip and shell, and the weaker, less extended callus.

R. mariei Morlet. Unfigured.

Shell very minute, ventricose, elongated, nearly smooth, ornamented at base with 4–5 spiral striæ; whorls 4½, convex, separated by an impressed suture; last whorl slightly more than half the length of the shell, subangulate at base; spire elevated; aperture narrow, margins joined by a thick callus; columellar margin arcuate, having three equal and equidistant, converging folds; lip nearly rectilinear, thick, provided with a tooth-like median tubercle and a basal fold below. Alt. 1½, diam. 1 mill. Var. minor, alt. 1. diam. 0·7 mill. (*Morl.*).

Island of Nossi-bé, near Madagascar (Folin).

R. mariei Morl., J. de C., 1880, p. 152.

One of the smallest species known. Smaller than *R. prismatica*, less ventricose, with two lip-teeth and a non-channelled suture. It has a deeper suture than *R. goujoni*, the second fold is stronger and the ornamentation different.

R. acuta Philippi.

Shell ovate-oblong, acuminate, transversely striated, the last whorl a little longer than the spire; aperture made ringent by the labrum being strongly thickened in the middle by a produced coarctate callus. Alt. 3½ mill.

Aden, Red Sea (Phil.); *Java* (Dupuy); *Gulf of Oman, Gwadar, Bombay, Ceylon, Arakan* (Nevill); *Singapore* (Stoliczka).

R. acuta Ph., Zeitschr. f. Mal. 1849, p. 33.—Morlet Journ. de Conch. 1878, p. 116.—Issel, Mal. Mar Rosso p. 137.—Nevill, J. A. S. Beng. xliv, pt. 2, p. 101.—*R. minuta* H. Ad., P. Z. S. 1872, p. 11, pl. 3, f. 14.

A narrow, acute form, almost exactly the same as *R. striata* Ph. (fossil), but the striæ less closs, less conspicuous, and the lip in adults strongly thickened within, produced in a blunt tooth in the middle. (Ph.).

Var. minuta H. Ad. Pl. 47, fig. 70.

Shell solid, acuminate-ovate, sculptured with distant transverse sulci, white; spire acuminate; whorls 4, slightly convex, the last ample; aperture ear-shaped, inner lip moderately calloused, provided with two folds; parietal tooth conspicuous, delicate; lip thickened, one-toothed within. Alt. 1½, diam. ¾ mill.

Red Sea.

R. savignyi Morlet. Pl. 47, figs. 85, 86.

Shell small, ovate-globose, *smooth*, the spire short, acute; whorls 5, convex separated by a simple suture, the last whorl two-thirds the entire length of the shell, base rounded. Aperture coarctate, the margins joined by a callus; columellar margin arcuate, triplicate, the upper fold strong, lower folds thick immersed in the callus, which partly covers the canal; outer lip smooth, rectilinear, margined outside, inside for two-thirds of the length dilated, subdentate. Alt. 3, diam. 2½ mill. (*Morl.*).

Bay of Suez, Red Sea.

R. savignyi Morl., Journ. de Conch. 1878, p. 117, pl. 5, f. 1.—Savigny, Descr. de l'Egypte, Coq., pl. vi, f. 7.

R. prismatica Folin. Pl. 47, figs. 71, 76.

Shell small, ovate-globose, thick, solid, whitish, shining, sometimes subdiaphanous; whorls 5, subcarinated, rapidly increasing, the last very large, three-fourths the length of the shell, sulcate at base; suture simple; aperture elongated, oblique, channelled above, the right margin tridentate, reflexed over the base, the teeth subacute. (*Folin*).

Alt. 2·5, diam. 1·5 mill.

Port Louis, Mauritius (Nevill); *Mauritius* (Folin); *Andaman Is. and Ceylon* (Nevill).

R. prismatica Folin, Les Fonds de la Mer, i, p. 87, pl. 11, f. 1.—Morlet, Journ. de Conch. 1878, p. 118, pl. 5, f. 2.—*R. apicata* Nevill, Journ. Asiat. Soc. Beng. xl, pt. 2, p. 3, t. 1, f. 12, 12*a*; vol. xliv, p. 102.

Distinguished from *R. acuta var. minuta* by its polished aspect, and by the last whorl having only three striæ at base instead of being entirely striate; it is quite narrow and more contracted, less calloused, with more acute tooth. Fig. 66 of pl. 47 represents the synonymous *R. apicata.*

R. folini Morlet. Pl. 47, figs. 61, 62, 67.

Shell very minute, ventricose, thick, regularly and strongly striated; whorls 4½, slightly convex, separated by a slightly channelled suture, the last whorl half the total length, rounded at base; spire elongated; aperture narrow, the margins joined by a strong callus; columellar margin arcuate, triplicate, the folds equidistant and of equal size; lip nearly straight, thickened, prominent in the middle, varicose outside. (*Folin*).

Alt. 2·7, diam. 1 mill.

Carimata (Folin); *Singapore* (coll. Folin).

R. folini Morl. in Les Fonds de la Mer, iii, p. 268, pl. 1, f. 8 ("*R. follini*" in index, p. 334).—Morlet, Journ. de Conch. 1878, p. 119, pl. 5, f. 3.

R. CARON Hinds. Pl. 47, figs. 63, 64, 68.

Shell ovate, acuminate, striated, shining; whorls rounded, the last with subtransverse, rounded distant striæ; spire exserted; aperture subabbreviated, the lip corrugated. (*Hinds*).

Alt. 3·5, diam. 2·5 mill.

Strait of Malacca, 17 fms. (Hinds); *Goat Island, Port Jackson, Australia* 10 fms., *and Torres Strait* (Brazier); *Gwadar* (Blanf.).

R. caron HINDS., Zool. Voy. Sulphur, ii, p. 47, pl. 16, f. 15, 16, 1844; P. Z. S. 1844, p. 97.—ANGAS, P. Z. S. 1871, p. 98.—NEVILL, Journ. Asiat. Soc. Beng. xliv, pt. 2, p. 101, 102, 1875.—MORL., Journ. de Conch. 1878, p. 121, pl. 5, f. 7.—BRAZIER, Proc. Linn. Soc. N. S. Wales, ii, p. 77.

This species is perfectly distinct in all its characters from *R. acuta;* the right margin particularly is very different; the distinct development of the parietal tooth, the different texture and the striation are all distinguishing characters from *R. acuta.*

R. ENCARPOFERENS Folin. Pl. 47, fig. 65.

Shell minute, globose, white, sometimes subdiaphanous, shining, spirally regularly sulcate; whorls 4, rapidly increasing, the last very large, five-sixths the length of the shell; suture simple; aperture elongate, the right margin strongly lipped, crenulated with rather rounded liræ, outside broadly extended over the last whorl, inside tumid toward the median part; emarginate at base; left margin strongly reflexed and thickened, strongly toothed within, outwardly irregularly crenulated (*Folin*).

Alt. 2·5, diam. 2·2 mill. (*Folin*).

Alt. 3, diam. 2·5 mill. (*Nev.*)

Point of Pamalang, Batavia, and N. coast of Sava (Folin); *Balapiti, Ceylon* (Nevill).

R. encarpoferens FOLIN, Les Fonds i, p. 66, pl. 6, f. 5, 1867–1871. —MORL., Journ. Conch. 1878, p. 121, pl. 5, f. 5.—*R. abbreviata* G. & H. NEVILL, Journ. Asiat. Soc. Beng. xliv, pt. 2, p. 102, 1875.

R. CANALICULATA Folin. Pl. 47, fig. 69.

Shell minute, ovate-globose, thick, solid, white, shining, lower half most minutely transversely sulcate; spire short, subacute; whorls 5, subconvex, rapidly increasing, separated by a rather deep

suture; last whorl very large, three-fourths the length of the shell; aperture narrow; canal wide, truncated in front; right margin strongly lipped, lip thick, very wide, exceeding the last whorl, strongly one-toothed within; left margin wide, reflexed, thickened, sulcate, three-toothed within, the teeth prominent and elongated. Alt. 3·8, diam. 2·8 mill. (*Folin.*)

Point Pamalang; *Hong Kong* (Folin); *Java* (Desh.).

R. canaliculata Folin, Les Fonds i, p. 67, pl. 6, f. 6.—Morlet Journ. de Conchyl. 1878, p. 120, pl. 5, f. 6.

The Java example of the Deshayes collection constitutes a variety of smaller size. (*Morl.*).

R. propinquans Hinds. *Unfigured.*

Shell ovate, retuse, striated, shining; whorls rounded, the last large, well rounded, closely striated. Alt. 1½. lines (*Hds.*)

Sual, Philippines, 5–7 fms.

R. propinquans Hinds, P. Z. S. 1844, p. 96.—Smith, P. Z. S. 1871, p. 733.—Lischke, Jap. Meeres-Conch. ii, p. 78, 79.—Morl., Journ. de Conch., 1878, p. 122.

Here the last whorl is not so square in shape, but very full and rounded, and is neatly striated in a very regular manner, and the spire is short. Till the light is properly thrown on them, these striæ are not very evident, but once discovered they will be found constant (*Hinds*).

R. exserta Hinds. *Unfigured.*

Shell ovate, acuminate, smooth, polished whorls rounded, smooth; spire elongate; lip strongly thickened behind. Alt. 1⅔ lines (Hinds).

Camiguing, 40 fms.; *Sorsogon, Luzon*, 6 fms. *Philippines; Port Jackson, Australia* (Brazier).

R. exserta Hinds, P. Z. S. 1844, p. 97.—Angas, P. Z. S. 1871, p. 98.—Morl., Journ. de Conch., 1878, p. 123.

Compared with *R. grandinosa*, the last whorl is small, but agrees in being quite smooth and round; the spire is elongated as in *R. caron*, and the labrum is even rather more reflected than is usual (*Hinds*).

R. GRANDINOSA Hinds. Pl. 47, fig. 72.

Shell ovate, retuse, smooth, polished; whorls rounded, the last large, subquadrate, rotund; columella strongly calloused above, denticulate. Alt. 1⅜ lines (*Hinds*).

Bais Negros, 6 fms.; *Cagayan Mindanao*, 26 fms.; *Catbalonga, Samar*, 10–30 fms.; *Sorsogon, Luzon* (Cuming); *Whydah, West Africa* (Smith); *off Katow, New Guinea* (Brazier).

R. grandinosa HINDS, P. Z. S. 1844, p. 96.—SMITH, P. Z. S. 1871, p.733.—MORL., Journ. de Conch., 1878, p. 123, pl. 5, f. 8.—BRAZIER, Proc. Linn. Soc., N. S. Wales, ii, p. 78.

R. GOUJONI Folin. Pl. 47, fig. 73.

Shell minute, ovate, subelongate, thick, solid, white, shining; spirally regularly sulcate; whorls 5, rather rapidly increasing, joined by a simple suture, the last very large, equalling two-thirds the length of the shell; aperture narrow, a little oblique, the right margin lipped, lip thick, bidentate; left margin strongly reflexed, thickened, tridentate. Alt. 2·1, diam. 1·1 mill. (*Folin*).

N. coast of Java (Folin); *New Caledonia* (Lambert).

R. goujoni FOLIN, Les Fonds i, p. 67, pl. 6, f. 4; *t. c.* p. 82, var.—MORLET, Journ. de Conch., 1878, p. 120, pl. 5, f. 4.

R. FOSSULATA Folin. Pl. 47, fig. 84.

Shell ovate, globose, the apex acuminate, white, shining; whorls 5, very rapidly increasing, smooth, at last very minutely spirally sulcate; last whorl large, four-fifths the total length; aperture a little elongated, made sinuous by large teeth; right margin strongly thickened, fossulate above, the margins of the slot joined above the rather prominent tooth, resembling a single riblet behind, and at base encircling the small rounded canal and passing inward above the lower left tooth; left margin strongly expanded in a wide, thick callus, bearing three teeth, superior tooth tricostulate. Alt. 3·6, diam. 1·8 mill. (*Folin*).

Port of Noumea, New Caledonia.

R. fossulata FOLIN, Les Fonds, i, p. 251, pl. 31, f. 9.—MORL., Journ. de Conch., 1878, p. 126, pl. 5, f. 11.

R. CALEDONICA Morlet. Pl. 43, figs. 14, 15.

Shell very minute, conic, rather thin, shining, spirally striated; whorls 5, slightly convex, subgradate, separated by a linear suture;

last whorl half the length of the shell, rounded at base; spire elongate; aperture narrow; margined joined by a thick callus; columellar margin arcuate, three-folded, the folds strong, upper one oblique, median horizontal, lower fold twisted; lip nearly straight, thick, prominent in the middle, subdentate, thickened outside.

Alt. 2, diam. 1 mill. (*Morl.*).

Bay of Pouen, New Caledonia, 12 meters depth.

R. caledonica Morl., J. de C., 1880, p. 154, pl. 5, f. 1.

The surface is brilliant and covered with spiral striæ, while *R. prismatica* is not striated over the greater part of the surface. The shell is more brilliant than that of *R. goujoni*, and the striæ are less crowded, and the lip has but one fold.

R. noumeensis Morlet. Pl. 43, figs. 20, 21.

Shell small, ovate-elongate, ornamented with remote striæ; whorls 5, convex, separated by a linear suture; last whorl two-thirds the length of the shell, rounded at base; aperture wide, the margins joined by a somewhat thickened, little expanded callus; columellar margin arcuate, three-folded, the upper fold thick, short, intermediate fold horizontal, lower fold ascending; lip regularly arcuate, thin above, thickened in the middle, prominent, subdentate, outside a little reflexed, the basal callus thick, reflexed outside. Alt. 3½, diam. 2 mill. (*Morl.*).

Nouméa, New Caledonia; Gouenen and Pouen, N. Caledonia (small var.).

R. noumeensis Morl., J. de C. 1880, p. 155, pl. 5, f. 3.

R. australis Hinds. Pl. 47, figs. 80, 81.

Shell ovate, acuminate, smooth, polished; whorls rounded, the penultimate sensibly smaller; spire elongated, encircled with a somewhat whitish band below the suture. Alt. 1½ lines. (*Hinds.*).

Port Lincoln (Mus. Metcalfe); *Spencer's Gulf* (Angas); *New Caledonia* (Lambert); *Darnley Island, Torres Strait* (Brazier).

R. australis Hinds, P. Z. S. 1844, p. 97.—Angas, P. Z. S. 1865, p. 156.—Crosse, Journ. de Conch. 1865, p. 44, pl. 2, f. 5.—Morl., J. de C. 1878, p. 125, pl. 5, f. 10.—*R. angasi* Braz., Proc. Linn. Soc. N. S. Wales ii, p. 78.

The only specimen before me has not attained its full adult age. In its characters it is rather intermediate; the spire is not so prom-

inently produced, and the penultimate whorl is more than usually developed, so as to be more intermediate in size between the others. All these species are of one uniform glassy semiopaque color, in some individuals being more glassy, in others more opaque. (*Hds.*).

Crosse gives the following description from a slightly worn specimen collected by Angas: Imperforate, oblong, rather thick, white, smooth; whorls 5½, moderately convex; the last longer than spire, rotund, attenuated at base, aperture coarctate, subauriform, margins joined by a strong callus which bears a rather prominent tubercle; columella dilated, biplicate, the basal fold larger; outer lip thick, reflexed. Alt. 3, diam. 1⅔ mill.

Mr. Brazier apparently did not recognize the fact that Crosse's *R. australis* is stated by him to be the species of Hinds.

R. DENTICULATA Gould. *Unfigured.*

Shell ovate, acuminate, solid, milk-white, engraved with transverse close striæ (narrower ones being sometimes intercalated); whorls 5, ventricose; aperture narrow, lip thickened, denticulate within, nearly interrupted at siphonal sinus, folds transverse, acute, callus moderate, hardly appressed, the parietal tooth moderate. Alt. 5, diam. 3·5 mill. (*Gld.*).

Port Jackson (Stimpson).

R. denticulata GLD., Proc. Bost. Soc. N. H. vii, p. 325 (Sept. 1860); Otia p. 121.

The numerous striæ, denticulate labium, and scantiness of callus about the siphonal notch, mark this species. (*Gld.*).

R. ABYSSICOLA Brazier. *Unfigured.*

Shell thin, white, somewhat acuminate, whorls 4½, moderately convex, opaque at the suture, smooth last whorl large, encircled below the center with four transverse lines; columella with two strong plaits turned back over the front of the last whorl, above with one prominent callus like tooth, joined to the upper part near the suture, aperture small, auriform; outer lip thickened and reflected, having in the center a prominent tubercular callosity, with a minute one below near the region of the small canal. Length ¾ diam., maj. ½ lines. (*Braz.*).

Darnley Island, Torres Straits 30 fathoms, sandy mud; 2 specimens.

R. abyssicola BRAZ., Proc. Linn. Soc. N. S. Wales ii, p. 78, 1877

R. PUSILLA Watson. Pl. 46, fig. 59.

Shell minute, ovate, subelongate, pointed, spirally striate from end to end, with slightly canaliculate and submarginated suture and a large mouth. Sculpture: Longitudinals—there are very slight hair-like lines of growth. Spirals—the whole shell is scored with strongish deepish distant furrows, which are rather more remote above than below the periphery; the first one below the suture is a little stronger than the others. Color glossy translucent white. Spire rather high, conical, regular, scalar. Apex small, rounded, the small tip being a very little prominent. Whorls 5, subcylindrical, slightly convex, the penultimate is rather high. Suture canaliculate and submarginated. Mouth large the teeth being small, suboblique. Outer lip somewhat obliquely drawn in and produced on the base, where it is round, patulous, and slightly sinuated; about the middle it is prominent and toothed; above it is narrowly and shallowly sinuated close to the body. Inner lip rather thinly and narrowly thickened, with a small tooth in the middle; two pillar-teeth are oblique, parallel, and nearly equal, the lower being the larger. Alt. 0·067 in. breadth 0·038. Mouth height 0·034, breadth 0·027 inch. (*Wats.*).

Flinders' Passage and Wednesday Island, Torres Straits, 3–8 fms.

R. pusilla WATS., J. L. Soc. Lond. xvii, p. 290; Chall. Rep. Gastr. p. 635, pl. 47, f. 9.

This species resembles *Ringicula goujoni* De Folin, more than any I know, but the shell is shorter here, with a lower spire and a less exserted tip. The suture in that species is very much less canaliculate, the mouth is smaller, and the spirals are much less numerous and are more remote.

R. ASSULARUM Watson. Pl. 46, fig. 60.

Shell small, somewhat lozenge-shaped, the left slope of the spire and the right base, the right slope of the spire and the left base being roughly parallel, smooth and without spiral furrows, with an obtuse spire, a small but blunt apex, and a mouth much contracted by the callus of the lips. Sculpture: Longitudinals—there are very slight rounded lines of growth. Spirals—none, except one feeble furrow toward the front of the base. Color glossy white, with a faint bluish tinge. Spire short, conical, very slightly subscalar. Apex very small, rounded, prominent, and a little elevated on one

side. Whorls 5, conical, convex; the first which is very small, is a little depressed, but at its origin stands up prominent on one side; the last, viewed as the shell lies on its face, is two-thirds of the whole length. Suture strongly marked, but not impressed, nor canaliculate nor marginated. Mouth small, oblique, very much narrowed by the teeth of both lips. Outer lip very much thickened, with a large prominent blunt tooth on the inner side above the middle; there is a shallow sinus above at the junction of the lip with the body, and a very small one at the point of the pillar. Inner lip: there is a thick toothed pad on the body; of the two pillar teeth, the lower, though stronger, is slightly less prominent than the upper. Alt. 0·11 in. diam. 0·07. Mouth, height 0·064, breadth to outside of callus on both lips, 0·058 inch. (*Wats.*).

Flinders Passage, Torres Strait, 7 fms.

R. assularum Wats., J. L. S. L. xvii, p. 291; Chall. Rep. Gastr., p. 635, pl. 47, f. 10.

This species is not unlike a small *Ringicula auriculata* Ménard de la Groye; but the spire is more depressed, the apex slightly flatter, and the extreme tip hardly so small. (*Wats.*).

ADDENDA.

Page 139, *after* S. suturalis A. Ad., *read* Pl. 20A, fig. 65.

Solidula reevei E. A. Smith. Pl. 20A, figs. 66, 67.

Shell short-ovate, acuminate above, rose-gray, with black dots. Whorls 7, turrited slightly convex, separated by a subcanaliculate suture; transversely sulcate; sulci narrow, longitudinally striated, 3–4 in penultimate, about 15 in last whorl; spire short, conic, acute. Aperture elongate, ear-shaped, about three-fifths the length of shell, showing series of black dots; columella twisted, thickened, white, bifid. Alt. 14, diam. 8 mill.

Habitat unknown.

Tornatella suturalis part, Reeve, Conch. Icon. xv, pl. 2, f. 9 *a*, *b*, not *S. suturalis* Ad.—*Actæon reevei* E. A. S., The Conchologist ii, p. 99, March, 1893. This species was figured by Reeve as *Torn. suturalis* A. Ad., but that species is longer and narrower than this, of a different ground color, and has the spiral sulci more strongly striated or subpunctate.

REFERENCE TO PLATES.

See page 117 for explanation of plates 1 to 17 of this volume.

Plate 18.

FIGURE.	PAGE.
68, 69. Leucotina dianæ Ad. C. Icon.,	167
70, 71. Leucotina lyrata Cpr. C. Icon.,	168
72. Leucotina casta Ad. Thes.,	172
73, 74. Leucotina speciosa Ad. Thes.,	172
75. Leucotina lauta Ad. Thes.,	172
76. Leucotina amoena Ad. Thes.,	172
77. Leucotina pura Ad. Thes.,	172
78–80. Mumiola spirata. Thes.,	See Vol. VIII, p. 315
81. Actæon albus Sowb. P. Z. S.,	152
82. Actæon oryza Rv. C. Icon.,	157
83. Actæon perconicus Dall. Proc. Nat. Mus.,	165
84, 85. Solidula alveola Sow. J. de C.,	145
86, 87. Actæon fabreanus Cr. J. de C.,	150
88, 89. Leucotina dianæ Ad. C. Icon.,	167
90, 91. Actæon senegalensis Pet. C. Icon.,	152
92, 93. Leucotina gigantea Dkr. Ind. Moll. Jap.,	167
94. Solidula alba Hutt. Pli. Moll. N. Z.,	146
95, 96. Actæon vagabundus Roch. Moll. Cap. H.,	164
97. Actæon semisculptus Sm. P. Z. S.,	152
98, 99. Actæon punctatus Orb. Moll. Cuba,	157
100, 101. Actæon venustus Orb. Voy. Am. Mérid.,	164

Plate 19.

1–3. Actæon monterosatoi Dantz. Camp. Sci.,	155
4. Actæon nitidus V. = exilis Jeffr. Tr. Conn. Ac.,	156
5, 6. Actæon exilis Jeffr. Camp. Sci.,	156
7–11, 15. Actæon tornatilis L.,	152
12. Actæon hebes V. Tr. Conn. Acad.,	159
13. Actæon mariæ Rv. C. Icon.,	148
14. Actæon tornatilis v. subulatus Wood. Crag Moll.,	153
16, 17. Actæon cumingi Ad. C. Icon.,	162
18, 19. Actæon siebaldi Ad. C. Icon.,	148
20, 21. Actæon pudicus Ad. C. Icon.,	150
22. Actæon punctostriatus Migh. J. Bost. Soc.,	157
23. Actæon punctostriatus Migh. Tr. Conn. Acad.,	157

Plate 20.

FIGURE.	PAGE.
24–26. Actæon austrinus Wats. Chall. Rep.,	140
27, 28. Actæon amabilis Wats. Chall. Rep.,	154
29, 30. Actæon turritus Wats. Chall. Rep.,	157
31. Actæon incisus Dall. Blake Rep.,	160
32. Actæon danaida Dall. Blake Rep.,	160
33. Actæon melampoides Dall. Blake Rep.,	158
34. Actæon incisus Dall. Blake Rep.,	160
35. Actæon delicatus Dall. Blake Rep.,	162
36. Actæon perforatus Dall. Blake Rep.,	159

Plate 20 A.

37, 38. Solidula solidula L. C, Icon.,	142
39. Solidula sulcata Gmel. Specimen,	143
40, 41. Solidula coccinata Rve. C. Icon.,	143
42, 43. Solidula tessellata Rv. C. Icon.,	140
44, 45. Solidula solidula L. Specimen,	142
46, 47. Solidula glabra Rv. = sulcata Gm. C. Icon.,	143
48. Solidula glabra Rv. = sulcata Gm. C. Icon.,	143
49, 50. Solidula cinerea Wats. Chall. Rep.,	140
Fig. above 51. Solidula fumata Rv. C. Icon.,	145
51. Solidula inculpta Rv. C. Icon.,	139
52. Solidula affinis Ad. Chall. Rep.,	141
53, 54. Solidula fratercula Dkr. Ind. Moll. Jap.,	138
55, 56. Solidula strigosa Gld. Jap. M.-Conch.,	137
57. Solidula nitidula Lam. C. Icon.	144
58, 59. Actæon flammeus Gmel. C. Icon.,	151
60, 61. Solidula intermedia Ang. P. Z. S.,	145
62. Solidula nivea Ang. P. Z. S.,	146
63, 64. Actæon virgatus Rv. C. Icon.,	151
65. Solidula suturalis Ad. C. Icon.,	139, 413
66, 67. Solidula reevei E. A. Sm. C. Icon.	413

Plate 21.

1. Retusa leucus Wats. Chall. Rep.,	208
2. Retusa complanata Wats. Chall. Rep.,	223
3. Retusa tornata Wats. Chall. Rep.,	209
4. Retusa amphizostus Wats. Chall. Rep.,	224
5. Retusa oryctus Wats. Chall. Rep.,	227
6. Retusa famelica Wats. Chall. Rep.,	225
7. Cylichna vortex Dall. Blake Rep.,	295
8. Retusa frielei Dall. Blake Rep.,	219
9, 10. Retusa simillima Wats. Chall. Rep.,	226
11, 12. Retusa truncatula Brug. Moll. Reg. Arct.,	205

Plate 22.

Figure.		Page.
13–15.	Tornatina recta Orb. Moll. Cuba,	184
16.	Tornatina harpa Dall. A. J. C.,	186
17–19.	Tornatina canaliculata Orb. = bullata. Moll. Cuba,	188
20.	Volvula minuta. Tr. Conn. Acad.	237
21, 22.	Tornatina candei Orb. Moll. Cuba,	185
23.	Tornatina canaliculata Say. Inv. Mass.,	184
24.	Tornatina obstricta Gld. = canaliculata Say,	185
25.	Tornatina exilis Dkr. Moll. Jap.,	190
26.	Tornatina inconspicua H. Ad. P. Z. S.,	192
27.	Tornatina fusiformis Ad. Thes.,	194
28.	Tornatina knockeri Sm. P. Z. S.,	188
29–31.	Tornatina voluta Q. & G. Astrol.,	195
32.	Tornatina voluta Q. & G. Thes.,	195
33.	Tornatina pusilla Iss. = isselii Pils. Mal. Mar Rosso,	191
34.	Tornatina oliviformis Iss. Savigny,	191
35, 36.	Tornatina brenchleyi Ang. P. Z. S.,	202
37, 38.	Tornatina hoffmani Ang. P. Z. S.,	203
39.	Cylichnella oryza. Thes.,	325
40, 41.	Haminea petiti Orb. Moll. Cuba,	359
42.	Cylichnella bidentata. Tr. Conn. Acad.,	325

Plate 23.

43, 44.	Retusa eumicra Crosse. J. de C.,	227
45.	Retusa apiculata Tate. Tr. & Rep. Phil. Soc.,	227
46.	Retusa borneensis Ad. Thes.,	222
47.	Retusa antarctica Pfr. Jahrb. Hamb.,	228
48, 49.	Retusa pertenuis Migh. Moll. Reg. Arct.,	216
50.	"Bulla" fragilis Velain Arch. Z. Ex.,	Vol. XVI.
51.	Retusa obtusa Mont. Thes.,	214
52.	Retusa obtusa var. territa Möll. Möll. Reg. Arct.,	215
53.	Retusa cecillei Phil. Thes.	222
54.	Retusa nitidula Lov. Möll. Reg. Arct.,	212
55–57.	Retusa semen Rve. Belch. Arct. Voy.,	216
58, 59.	Retusa gouldii Couth. Bost. Journ.,	217
60.	Retusa conulus = obesiuscula. Tr. Conn. Acad.,	231
61.	Retusa obesiuscula Brugn. Bull. Soc. Mal.,	231
62–64.	Retusa truncatula Brug. Moll. Rouss.,	205
65–67.	Retusa mamillata Ph. Moll. Rouss.,	206
68.	Retusa truncatula v. pellucida Sars.	206
69.	Retusa cælata Bush. Tr. Conn. Ac.,	232
70–72.	Retusa semisulcata Ph. Moll. Rouss.,	206
73, 74.	Retusa sulcata Orb. Moll. Cuba.,	221

Plate 24.

29, 30.	Tornatina leptekes Wats. Chall. Rep.,	200
31, 32.	Tornatina acrobeles Wats. Chall. Rep.,	201

FIGURE. PAGE.
33. Tornatina pachys Wats. Chall. Rep., ... 198
34–36. Retusa mariei Dautz. Camp. Sci., ... 207
37, 38. Tornatina avenaria Wats. Chall. Rep., . . . 202

Plate 25.

39–41. Tornatina protracta Dautz. Camp. Sci., . . . 182
42. Tornatina arata Wats. Chall. Rep., ... 199
43. Tornatina amboinensis Wats. Chall. Rep., . . . 196
44. Tornatina coarctata Ad. Thes., ... 193
45. Tornatina planospira Ad. Thes., ... 192
46. Tornatina biplex Ad. Thes., ... 192
47. Tornatina olivula Ad. = bullata Kn. Thes., . . . 183
48. Tornatina cinctella Ad. Thes., ... 193
49. Tornatina gracilis Ad. Thes., ... 194
50. Retusa oliviformis Wats. Chall. Rep., ... 207
51. Tornatina simplex Ad. Thes., ... 193
52. Tornatina polita Ad. Thes., ... 192
53–55. Retusa spatha Wats. Chall. Rep., ... 218

Plate 26.

56. Volvula sulcata Wats. Chall. Rep., ... 241
57. Volvula minuta Bush. Tr. Conn. Ac., ... 237
58, 59. Volvula paupercula Wats. Chall. Rep., . . . 238
60. Volvula rostrata Ad. Thes., ... 241
61, 62. Volvula acuminata Brug. M. Sars., ... 234
63. Volvula oxytata Bush. Tr. Conn. Acad., . . . 235
64. Volvula striatula Ad. Thes., ... 239
65. Volvula cylindrica Sm. = Smithii Pils. P. Z. S., . . 233
66. Volvula eburnea Ad. Thes., ... 239
67. Volvula angustata Ad. Thes., ... 240
68. Austrodiaphana brazieri Ang. P. Z. S., ... 287
69. Diaphana expansa Jeffr. Sars., ... 284
70, 71. Diaphana hyalina = minuta Brown, . . . 283
72–74. Diaphana densestriata Leche. Sv. Vet. Handl., . 285
75. Diaphana globosa Lov. Sars., ... 286
76, 77. Diaphana seguenzæ Wats. Chall. Rep., . . . 282
78–80. Cylichna semisulcata Dkv. Ind. Moll. Jap., . . 303

Plate 27.

81. Atys dentifera Ad. Thes., ... 276
82. Cylichna decussata Ad. Thes., ... 315
83. Cylichna involuta Ad. Thes., ... 310
84. Cylichna bizona Ad. Thes., ... 323
85. Cylichna biplicata Ad. Thes., ... 310
86. Cylichna marmorata Ad. Thes., ... 323

FIGURE. PAGE.
87. Cylichna concentrica Ad. Thes., ... 314
88. Cylichna pyramidata Ad. Thes., ... 310
89. Cylichna elegans Ang. P. Z. S., ... 318
90. Cylichna ordinaria Sm. P. Z. S., ... 319
91. Tornatina involuta Nev. J. A. S. B., ... 196
92, 93. Cylichna arachis Q. & G. Astrol., ... 318
94. Cylichna mica Ehrenb. Savigny, ... 311
95. Cylichna pulvisculus Ehrenb. Savigny, ... 311
96. Cylichna mongii Aud. Savigny, ... 311
97. Cylichna atlantica Sm. P. Z. S., ... 322
98. Cylichna villiersi Aud. Savigny, ... 312
99, 100. Cylichna grimaldi Dautz. Mém. Soc. Zool. Fr., . 291
1. Tornatina lactuca Nev. J. A. S. B., ... 196
2–4. Cylichna crebripunctata Jeffr. P. Z. S., . . . 293
5. Cylichna eburnea Ver. Tr. Conn. Acad., . . . 298
6. Retusa robagliana Fisch. Les Fonds., ... 213
7, 8. Retusa crebrisculpta Monts. Mém. Z. Soc. Fr., . . 211
9. Cylichnella bidentata Orb. Tr. Conn. Acad., . . . 325

Plate 28.

11–13. Atys naucum L. C. Icon., ... 263
14, 15. Atys naucum v. ferruginosa. C. Icon., . . . 264
16. Atys ovoidea = obovata Mke. Thes., ... 264
17. Atys monodonta Ad. C. Icon., ... 276
18. Atys parvula Ad. Thes., ... 270
19. Atys nonscripta Ad. Thes., ... 268
20. Atys muscaria Gld. C. Icon., ... 264
21, 22. Atys parallela Gld. U. S. Exped., ... 266
23. Atys porcellana Gld. C. Icon., ... 268
24. Atys exigua Ad. Thes., ... 270
25. Atys hordeacea Ad. Thes., ... 270
26, 27. Atys attenuata Sowb. C. Icon., ... 268
28, 29. Atys utriculus Brocc. F. & H., ... 279
30. Atys semistriata Pse. Don. Bism., ... 267
31, 32. Haminea ovoidea Q. & G. Astrol., ... 366
33, 34. Atys caribæa Orb. Moll. Cuba, ... 274
35. Atys scalpta Rve. K. Vet. Akad, ... 292
36. Atys occulta Migh. Bost. Journ., ... 292
37–40. Atys propinqua Sars. Sars., ... 292
41. Atys reinhardi Möll. K. Vet. Akad., ... 292
42. Atys speciosa Ad. Thes., ... 275
43. Haminea solitaria Say. Thes., ... 357
44. Haminea solitaria Say. Inv. Mass., ... 357
45. Atys ovulata Brocc. = brocchii Mich. Thes., . . 277
46. Atys guildinii Sowb. Thes., ... 274

Plate 29.

FIGURE.		PAGE.
1–3.	Cylichna chevreuxi Dautz. Camp. Sci.,	291
4–7.	Cylichna richardi Dautz. Camp. Sci.,	293
8–10.	Retusa crossei B. D. & D. Moll. Rouss.	211
11.	Retusa umbilicata Mont. Sars.,	210
12–14.	Retusa umbilicata Mont. Moll. Rouss.,	210
15–17.	Cylichna cylindracea Penn. Moll. Rouss.,	289

Plate 30.

1, 2,	Cylichna noronyensis Wats. Chall. Rep.,	301
3, 4.	Cylichna labiata Wats. Chall. Rep.,	313
5, 6.	Cylichna reticulata Wats. Chall. Rep.,	316
7.	Cylichna discus Wats. Chall. Rep.,	299
8, 9.	Cylichna subreticulata Wats. Chall. Rep.,	317
10.	Cylichna tahitensis Wats. Chall. Rep.,	320
11.	Retusa ovata Jeffr. Chall. Rep.,	232
12.	Cylichna crispula Wats. Chall. Rep.,	315

Plate 31.

13, 14.	Scaphander mundus Wats. Chall. Rep.,	251
15.	Scaphander niveus Wats. Chall. Rep.,	252
16.	Scaphander punctostriatus Migh. Sars.,	246
17.	Scaphander lignarius L. Sars.,	245
18.	Scaphander watsoni Dall. Blake Rep.,	248
19, 20.	Scaphander gracilis Wats. Chall. Rep.,	247
21, 22.	Scaphander lignarius L. Moll. Esp.,	245
23.	Scaphander lignarius L. Moll. Rouss.,	245

Plate 32.

24, 25.	Scaphander lignarius L.,	245
26.	Scaphander interruptus Dall. Proc. U. S. Nat. Mus.	250
27, 28.	Scaphander bathymophila Dall. Blake Rep.,	256
29, 30.	Atys gibbulus Jeffr. = diaphana Arad. Ann. Mag.	278
31, 32.	Scaphander nobilis Verril. Tr. Conn. Acad.,	249
33, 34.	Scaphander issellii Bell. Bull. Soc. Mal. Ital.,	255
35.	Atys sandersoni Dall. Blake Rep.,	275
36.	Atys hyalina Wats. Chall. Rep.,	271
37.	Atys freyi Brancsik = naucum L.,	264
38, 39.	Diaphana seguenzæ Wats. Chall. Rep.,	282

Plate 33.

40, 41,	Smaragdinella andersoni Nev. J. A. S. B.,	260
42.	Smaragdinella glaucä = viridis. Thes.,	258
43, 44.	Smaragdinella glaucä Q. & G. Astrol.,	259

FIGURE. PAGE.
45, 46. Smaragdinella glaucä = viridis. C. Icon., . . 258
47, 48. Smaragdinella viridis Rang. Enlarged, . . . 258
49–52. Smaragdinella viridis Rang. Astrol., . . . 258
53. Smaragdinella viridis Rang. Thes., ... 258
54, 55. Smaragdinella fasciata Sowb. C. Icon., . . . 259
56, 67. Smaragdinella acuminata Sowb. = viridis. C. Icon. 259
58. Smaragdinella minor Ad. Thes., ... 259
59. Smaragdinella algiræ Hanl. Thes, ... 261
60. Atys cylindrica Helbl. Thes., ... 265
61. Atys cylindrica Helbl. Roe., ... 265
62. Atys elongata Ad. Thes., ... 266
63, 64. Atys solida Brug. Thes., ... 266
65. Pyrunculus nitida Ad. Thes., ... 230
66, 67. Atys tortuosa Ad. C. Icon., ... 264
68. Pyrunculus pyriformis Ad. Thes., ... 229
69, 70. Atys debilis Pse. Don. Bism., ... 266
71, 72. Atys amygdala Sowb. C. Icon., ... 268
73. Atys succisa Ad. Thes., ... 266
74. Atys alicula Ad. Thes., ... 267

Plate 34.

1, 2. Bulla ampulla L. Thes., ... 343
3. Bulla ampulla L. C. Icon., ... 343
4. Bulla ampulla v. trifasciata. C. Icon., ... 344
5. Bulla ampulla v. bifasciata. Specimen, ... 344
6, 7. Bulla cruentata Ad. C. Icon., ... 345
8, 9. Bulla tenuissima Sowb. C. Icon., ... 347

Plate 35.

12–14. Bulla oblonga Ad. C. Icon., ... 346
15, 16. Bulla australis Ad. = adamsi Mke. Thes., . . 345
19, 20. Bulla australis Ad. = adamsi Mke. C. Icon., . . 345
17, 18. Bulla australis Q. & G. Astrol., ... 346

Plate 36.

21. Bulla eburnea Dall. Blake Rep., ... 339
22, 23. Bulla nebulosa Gld. = gouldiana. C. Icon., . . 340
24. Bulla gouldiana Pils. Specimen, ... 340
25, 26. Bulla aspersa Ad. C. Icon., ... 341
27, 28. Bulla aspersa. Specimen, ... 341
29, 30. Bulla punctulata Ad. C. Icon., ... 341
31. Bulla abyssicola Dall. Blake Rep., ... 338
32, 33. Bulla angasi Pils. C. Icon., ... 347
34, 35. Bulla ovula Sowb. C. Icon., ... 349

Plate 37.

FIGURE.		PAGE.
36–38.	Bulla solida Gmel. Specimen,	335
39.	Bulla punctata. Thes.,	341
40, 41.	Bulla punctata Ad. C. Icon.	342
42, 43.	Bulla striata Brug. Moll. Esp.,	332
44–46.	Bulla striata Brug. Sp. from Greece,	332
47, 48.	Bulla rufolabris Ad. Thes. & C. Icon.,	342

Plate 38.

49, 50.	Bulla media = amygdala Dillw. C. Icon.,	329
51–53, 55, 56.	Bulla occidentalis Ad. Specimens,	331
54.	Bulla solida Gmel. Specimens,	335
57–59.	Bulla occidentalis Ad. C. Icon. and Thes.,	331
60.	(= pl. 39, f. 78). Bulla occidentalis Ad. Specimen,	331
61.	Bulla adansoni Ph. C. Icon.,	333
62, 63, 65.	Bulla amygdala Dillw. Specimens,	329
64.	Bulla amygdala Dillw. C. Icon.,	329

Plate 39.

66, 67.	Bulla compressa Roch. Nouv. Arch. Mus.,	334
68–70.	Bulla guernei Dautz. Camp. Sci.,	336
71.	Bulla quoyi Gray. Erebus & Terror,	348
72.	Bulla incommoda Sm. P. Z. S.,	347
73.	Bulla conspersa Pse. A. J. C.,	349
74, 75.	Bulla adansoni v. minor. Ind. Moll. Guin.,	334
76.	Bulla rubiginosa Gld. Exped.,	330
77.	Bulla occidentalis Ad. Vera Cruz, Mex.,	331
78.	Bulla occidentalis Ad. Lake Worth, Fla.,	331
79.	Bulla amygdala Dillw. St. Thomas,	329

Plate 40.

80, 81.	Haminea natalensis Kr. Südaf. Moll.,	367
82.	Haminea tenera Ad. Thes.,	371
83.	Haminea vitrea Ad. Thes.,	370
84.	Haminea curta Ad. Thes.,	368
85.	Haminea issellii = curta. P. Z. S.,	368
86.	Haminea pemphis Sowb. = zelandica. C. Icon.,	373
87.	Haminea tenella = pemphis Ph. Thes.,	368
88.	Haminea elegans Gray. C. Icon.,	355
89.	Haminea fusca Ad. Thes.,	369
90.	Haminea fusca Ad. C. Icon.,	369
91.	Haminea papyrus Ad. Thes.	371
92.	Cylichna brevissima Ad. Thes.,	310
93.	Haminea angustata Ad. Thes.,	361
94.	Haminea ovalis Pse. A. J. C.,	365

FIGURE. PAGE.
95. Haminea simillima Pse. A. J. C., ... 366
96. Haminea brevis Q. & G. Thes., ... 373
97. Haminea sinensis = exarata Ph. Thes., . . 362
98, 99. Haminea constricta Ad. C. Icon., ... 370
100. Haminea nigropunctata Pse. Don Bism., . . 365
1, 2. Haminea galba Pse. C. Icon., ... 364
3. Haminea crocata Pse. Specimen, ... 363
4. Haminea sandwichensis Sowb. C. Icon., . . . 365
5. Haminea virescens Sowb. C. Icon., ... 360
6, 7. Haminea cymbalum Q. & G. Astrol., . . . 367
8. Haminea ambigua Ad. Thes., ... 371
9, 10. Haminea brevis Q. & G. Astrol., . . . 373

Plate 41.

11. Haminea zelandiæ Gray. Erebus & Terror, . . . 373
12. Haminea obesa = zelandiæ Gray. C. Icon., . . 373
13. Haminea cuticulifera Sm. Alert, ... 372
14. Haminea castanea Ad. Thes., ... 374
15. Haminea flavescens Ad. Thes., ... 374
16. Haminea rotundata Ad. Thes., ... 375
17, 18. Haminea navicula Da C. F. & H., Moll. Rouss., . 353
19, 20. Haminea hydatis L. Moll. Esp., ... 354
21, 22. Cylichna auberii Orb. Moll. Cuba, . . . 300
23, 24. Haminea petitii Orb. Moll. Cuba, . . . 359
25, 26. Haminea vesicula Gld. Specimen, . . . 359
27. Haminea natalensis = peruviana. Thes., . . 361
28, 29. Haminea vesiculata Gld. Specimen, . . 359
30, 31. Haminea guadaloupensis Sowb. Specimen, . . 358
32. Haminea solitaria Say. Specimen, ... 357
33, 34. Haminea guadaloupensis Sowb. Specimen, . . 358
35, 36. Haminea antillarum Orb. Specimen, . . 358
37. Haminea guildingii = elegans. C. Icon., . . . 355
38, 39. Haminea elegans Gray. Specimen, ... 355

Plate 42.

11, 12. Akera bullata Müll. Moll. Arct. Norv., . . . 377
13. Akera bicincta Q. & G. Thes., ... 379
14. Akera tumida Ad. Thes., ... 379
15. Akera bicincta Q. & G. Astrol., ... 379
16. Akera tenuis Ad. = soluta. Thes., ... 378
17. Akera hanleyi = bullata. Thes., ... 377
18. Akera soluta Gmel. C. Icon., ... 378
19, 20. Cylindrobulla beauii Fisch. J. de C., . . 380
21–23. Volvatella pyriformis Pse. Don. Bism., . . . 383
24–26. Cylindrobulla pusilla Nev. J. A. S. B., . . . 382
27, 28. Volvatella fragilis Pse. A. J. C., ... 384

FIGURE. PAGE.
29, 30. Volvatella candida Pse. A. J. C., ... 385
31, 32. Cylindrobulla fragilis Jeffr. Ann. Mag., . . . 380
33–35. Volvatella cincta Nev. J. A. S. B., ... 383
36–38. Cylindrobulla sculpta Nev. J. A. S. B., . . . 381

Plate 43.

1, 2. Bulla solida Gmel. Specimen, ... 335
3–5. Haminea peruviana Orb. Voy. Am. Mér., . . . 361
6. Haminea navicula DaCosta. F. & H., ... 352
7, 8. Bulla quoyi Gray. Astrol., ... 327
9, 10. Haminea ovalis Pse. A. J. C., ... 365
11, 12. Haminea simillima Pse. A. J. C., ... 366
13. Haminea nigropunctata Pse. A. J. C., ... 365
14, 15. Ringicula caledonica Morl. J. de C., . . . 409
16. Atys blainvilliana Recl. Faune Fr., ... 278
17. Haminea aperta Pse. A. J. C., ... 366
18. Haminea glabra Ad. Specimen, ... 356
19. Haminea virescens Sowb. Specimen, ... 360
20, 21. Ringicula noumeensis Morl. J. de C., . . . 410

Plate 44.

1–4, 6. Hydatina amplustre. L. specimen, C. Icon., Thes., . 390
5. Hydatina amplustre L. Astrol., ... 390
7, 10. Hydatina velum Gmel. Thes., ... 388
8, 9. Hydatina velum Gmel. Specimen, ... 388
11–13. Hydatina inflata Dkr. Ind. Moll. Jap., . . . 389

Plate 45.

14. Hydatina physis var. staminea, specimen, . . . 388
15. Hydatina physis L. Specimen, ... 387
16. Hydatina physis L. C. Icon., ... 387
17. Hydatina physis L. Astrol., ... 387
18, 19. Bullina ziczac = scabra Gmel. Don. Bism., . . 176
20. Bullina lauta = scabra Gmel. 176
21, 22. Bullina lineata = scabra Gmel. Thes. & C. Icon., . 176
23, 24. Bullina bruguierei Ad. Thes. & C. Icon., . . 177
25, 26. Bullina vitrea Pse. C. Icon., ... 177
27, 28. Bullina deshayesii Pils. Moll. Réun., . . . 178
29, 30. Hydatina albocincta Hoev. Thes. & C. Icon., . . 388

Plate 46.

31. Ringicula leptochila = nitida. J. de C., . . . 399
32. Ringicula moritzi Fol. J. de C., ... 402
33, 34. Ringicula conformis Monts. J. de C., . . . 396

FIGURE. PAGE.
35, 36. Ringicula pulchella Morl. J. de C., ... 398
37. Ringicula peracuta Wats. Chall., ... 400
38. Ringicula nitida Verrill. Tr. Conn. Ac., . . . 399
39, 40. Ringicula passieri Morl. J. de C., ... 398
41, 42. Ringicula terqueri Morl. J. de C., ... 396
43, 44. Ringicula semistriata Orb. Moll. Cuba, . . . 399
45, 46. Ringicula admirabilis Morl. J. de C., . . . 397
47, 48. Ringicula cabriei Morl. J. de C., ... 401
49. Ringicula auriculata Mén. J. de C., ... 395
50. Ringicula auriculata Mén. J. de C., ... 395
51. Ringicula buccinea Brocc. J. de C., ... 395
52. Ringicula somersi Folin. J. de C., ... 402
53, 54. Ringicula schlumbergeri Morl. J. de C., . . . 396
55, 56. Ringicula senegalensis Morl. J. de C., . . . 402
57. Ringicula suturalis Sm. P. Z. S, ... 401
58. Ringicula somersi Fol. Les Fonds., ... 402
59. Ringicula pusilla Wats. Chall. Rep., ... 412
60. Ringicula assularum Wats. Chall. Rep., . . . 412

Plate 47.

61, 62. Ringicula folini Morl. J. de C., ... 406
63, 64. Ringicula caron Hde. Voy. Sulphur, . . . 407
65. Ringicula encarpoferens Fol. J. de C., . . . 407
66. Ringicula apicata Nev. J. A. S. B., ... 406
67. Ringicula folini Morl. Les Fonds., ... 406
68. Ringicula caron Hinds. J. de C., ... 407
69. Ringicula canaliculata Foli. J. de C., . . . 407
70. Ringicula minuta H. Ad. P. Z. S., ... 405
71. Ringicula prismatica. J. de C., ... 406
72. Ringicula grandinosa Hinds. J. de C., . . . 409
73. Ringicula gonjoni Fol. J. de C., ... 409
74, 75. Ringicula arctata Gld. J. M.-C., ... 403
76. Ringicula prismatica Fol. Les. Fonds., . . . 406
77, 78. Ringicula œlertiana Morl. J. de C., . . . 404
79. Ringicula arctata Gld. J. de C.. 403
80, 81. Ringicula australis Hinds. J. de C., . . . 410
82, 83. Ringicula doliaris Gld. Chall. Rep., . . . 403
84. Ringicula fossulata Folin. Les Fonds., . . . 409
85, 86. Ringicula savignyi Morl. Coq. Egypte., . . . 405

Plate 48.

1. Stomach of Haminea navicula opened. Ann. Sc. Nat., . 352
2, 3. Stomach plate of Haminea navicula. Ann. Sc. Nat., . 352
4. Bulla ampulla L., dentition. Pilsbry, del., . . . 328
5. Akera bullata Müll. Meyer & Möbius, ... 376
6. Volvatella vigourouxi Montr. J. de C., ... 383

FIGURE. PAGE.
7. Volvatella cumingi Ad. Thes., ... 385
8. Haminea diaphana Couth. U. S. Exped., . . . 356
9, 10. Cylindrobulla sowerbiei Montr. J. de C., . . . 381
11. Volvutella candida Pse. A. J. C., ... 385
12. Cylichna domitus Dall. Blake Rep., ... 294
12*a*. Atys caribæa Orb. Specimen, ... 274
13. Cylichna dalli Verrill. Tr. Conn. Acad., . . . 297
14. Cylichna strigella A. Ad. Thes., ... 314
15–17. Bulla nebulosa, gizzard-plate. Pilsbry, del., . . 328
18. Haminea succinea Conr. Specimen, ... 357
19, 20. Bulla roperiana Pils. Specimen, ... 336
21. Bulla adansoni Phil. Specimen, ... 334

Plate 49.

1, 2. Actæon tornatilis L. Moll. Reg. Arct., . . . 148
3. Actæon tornatilis L., ... 148
4. Actæon luteofasciata Mühlf. Berl. Verh., . . . 155
5, 6. Actæonina chariis Wats. Chall. Rep., . . . 174
7. Leucotina niphonensis Ad. C. Icon., ... 168
8, 9. Leucotina modesta Ad. C. Icon., ... 170
10, 11. Actæon bullatus Gld. Expl. Exped., . . . 163
12, 13. Actæonina edentula Wats. Chall. Rep., . . . 173
14–16. Leucotina sinuata Ang. P. Z. S., ... 171
17, 18. Solidula solidula L. Gen. Rec. Moll., . . . 142
19. Leucotina esther Ang. P. Z. S., ... 170
20, 21. Ovulactæon meekii Dall. Blake Rep., . . . 178
22, 23. Leucotina elongata Sowb. Sh. S. Af., . . . 172
24. Actæon punctocælatus Cpr. Specimen, ... 166

Plate 50.

25, 26. Tornatina canaliculata Say. Pilsbry, del., . . 184
27–29. Tornatina candei Orb. Pilsbry, del., . . . 185
30. Tornatina bullata Kn. Pilsbry, del., ... 183
31–34. Tornatina singaporensis Pils. Pilsbry, del., . . 194
35–37. Tornatina capitata Pils. Pilsbry del., . . . 195
38. Tornatina culcitella Gld. Pilsbry del., ... 189
39, 40. Tornatina cerealis Gld. Pilsbry del., . . . 188

NOTE.—The numbers 51 to 58 are omitted from the series of plates, Pl. 50 being followed by Pl. 59.

Plate 59.

1, 2. Atys jeffreysi Weink. Ann. Mag., ... 277
3. Atys brocchii Mich. Conch. foss. subap., . . . 277
4, 5 Cylichna parvula Jeffr. Ann. Mag., ... 293
6. Cylichna sarsii Ad. Thes., ... 322

FIGURE. PAGE.

7. Cylichna minuta = villiersi. P. Z. S., ... 312
8. Cylichna brevissima Ad. Thes., ... 310
9. Cylichna pygmæa Ad. Thes., ... 319
10. Cylichna concinna Ad. Thes., ... 309
11, 12. Cylichna striata Hutt. Specimen, ... 319
13. Atys utriculus Brocchi. F. & H., ... 279
14. Chelidonura adamsii Ang. P. Z. S. . . See Vol. XVI
15. Tornatina inculta Gld. Specimen, ... 188
16, 17. Atys cylindrica Hebl. Anim. Evert., . . . 262
18, 19. Micromelo eximia Dh. Moll. Réun., . . . 393
20, 21. Micromelo undata Brug. Thes., ... 392
22–24. Micromelo undata Brug. Specimens, . . . 392
25, 26. Micromelo guamensis Q. Voy. Uranie, . . . 392
27. Diaphana debilis Gld. Specimen, ... 281
28. Diaphana hiemalis Conth. Specimen, ... 286
29–31. Diaphana ventricosa Jeffr. Ann. Mag., . . . 284
32, 33. Diaphana lottæ Bush. Bull. M. C. Z., . . . 281

Plate 60.

1–3. Retusa truncatula Brug. Meyer & Möb., . . . 204
4. Retusa truncatula Brug. Moll. Reg. Arct., . . . 204
5, 6, 7. Retusa nitidula Sars. Moll. Reg. Arct., . . . 204
8. Retusa umbilicata. Moll. Reg. Arct., ... 204
9, 10. Volvula acuminuta Brug. M. Sars., ... 233
11. Volvula brevis Pils. F. & H., ... 235
12, 13. Volvula acuta Orb. Moll. Cuba, ... 236
14, 15. Volvula corticata Beck. Moll. Reg. Arct., . . 291
16. Volvula alba Brown. Moll. Reg. Arct. 290
17. Leucotina minuta Smith. P. Z. S., ... 171
18. Tornatina voluta Q. Samarang, ... 181

Plate 61.

20, 21. Diaphana minuta Br. Moll. Reg. Arct., . . . 280
22. Diaphana expansa Sars. Moll. Reg. Arct., . . . 280
23. Cylichna cylindracea Penn. F. & H., ... 287
24–27. Cylichna alba Brown. Moll. Reg. Arct., . . . 288
28–31, 38. Akera bullata Müll. Moll. Reg. Arct., . . 376
33–37, 39, 40. Scaphander lignarius L. Moll. Reg. Arct., . 244
32. Atys utriculus Brocchi. Moll. Reg. Arct., . . . 262

INDEX TO TECTIBRANCHIATA,

WITH SPIRAL, EXTERNAL SHELLS.

NOTE.—The names of species believed to be valid are printed in Roman type; the names of genera and other groups in SMALL CAPITALS; the names of all synonyms are in *Italic* type.

Abbreviata Nev., . . 407
Abyssicola Braz., . . 411
Abyssicola Dall, . . 338
Abyssorum Morl., . . 397
Acera Auct., . . . 376
Aceras Loc., . . . 376
Acrobeles Wats., . . 201
ACTÆONIDÆ, . . . 135
Actæonidea Gabb, . . 166
ACTÆONINA Orb., . 136, 172
ACTÆON Montf. . 136, 147
Actæon Oken, . . . 147
ACTÆOPYRAMIS, Fisch., . 167
Acteon Montf., . . . 147
Acuminata Brug., . . 234
Acuminata Sow., . . 259
Acuta Orb., . . . 236
Acuta Ph., . . . 138
Acuta Phil., . . . 405
Adamsi Braz., . . . 346
Adamsi Cpr., . . . 341
Adamsii Dkr., . . . 364
Adamsii Gray, . . . 261
Adamsi Mke., . . . 345
Adansoni Phil., . . 333
Admirabilis Morl., . . 397
Adspersa Schr., . . . 350
Æquistriata Sm., . . 369
Affinis Ad., . . . 141
Akera Gmel., . . . 377
AKERA Müll., . . . 376
AKERIDÆ Pils., . . 350
AKERINÆ Pils., . . 351
Alba Br., ... 290
Alba Hutt., . . . 146
Alba Swains, . . . 290
Albocincta Hoev., . . 388
Alboguttata Sm., . . 324
Albus Hutt., . . . 146
Albus Sowb., . . . 152
Algiræ Hanl., . . . 261
Alicula Ad., . . . 267
ALICULA Ehr., . . 262, 265
Alveola Souv., . . . 145
Amabilis Wats., . . 154
Ambigua Ad., . . . 371
Amboinensis Wats., . . 196
Amœna Ad., . . . 172
Amphisphyra Lov., . . 280
Amphizostus Wats., . . 224
Amphorella Ad., . . 264
Amplustra Born., . . 388
Amplustre L., . . . 390
Ampula Montf., . . 327
Ampulla L., . . . 343
Ampulla Orb., . . . 335
Ampulla Penn., . . 353
Amygdala Dillw., . . 329
Amygdala Sowb., . . 268
ANASPIDEA, . . . 134
Andersoni Nev., . . 260
Angasi Braz., . . . 410
Angasi Pils., . . . 347
Angusta Gld., . . . 361

Angustata Ad., . . . 240
Angustata Sowb., . . 266
Angustata Sowb., . . 361
Annulata Schr., . . . 350
Antarcticus Pffr., . . 228
Antillarum Orb., . . 358
Aperta Pse., . . . 366
Apicata Nev. . . . 406
Apicina Gld., . . . 201
Apiculata Tate, . . 227
Aplustra Sw., . . . 389
Aplustre Lam., . . . 390
Aplustridæ, . . . 385
APLUSTRUM Schum., . 386, 389
Arachis Q., . . . 318
Arata Wats., . . . 199
Arctata Gld., . . . 403
Aspersa Ad., . . . 341
Aspinosa Dall, . . . 237
Assimilis Ad., . . . 306
Assularum Wats., . . 412
Assula Schum., . . . 244
Atkinsoni T.-W., . . 318
Atlantica Sm., . . . 322
Atrolineata Schr., . . 387
Attenuata Ad., . . . 240
Attenuata Dall, . . . 333
Attenuata Sowb., . . 268
Attonsa Cpr., . . . 302
ATYS Montf., . . 243, 261
Auberi Orb., . . . 300
Auriculata Mén., . . 395
Australis Gray, . . . 346
Australis Hds., . . . 410
Australis Q. & G., . . 165
Australis Q. & G., . . 346
Austrinus Wats., . . 149
AUSTRODIAPHANA Pils., . 287
Avenaria Wats., . . 202

Bacillus Ehr., . . . 311
Bathymophila Dall, . . 256
Beaui Fisch., . . . 380
Bicincta Q. & G., . . 379
Bidentata Orb., . . . 325
Bifasciata Gm., . . . 153
Bifasciata Mke., . . 344
Bifasciatus Risso, . . 153
Biplex Ad., . . . 192
Biplicata Ad., . . . 310
Biplicata Lea, . . . 325
Bizona Ad., . . . 323
Blainvilliana Recl., . . 278
Borneensis Ad., . . . 222
Bourguignati Roch., . . 403
Brazieri Ang., . . . 287
Brazieri Pils., . . . 315
Brenchleyi Ang., . . 202
Brevis Pils., . . . 235
Brevis Q. & G., . . . 373
Brevissima Ad., . . 310
Brocchii Mich., . . . 277
Brownii Leach, . . 245
Bruguieri Ad., . . . 177
Buccinea Broc., . . . 395
Buccinulus Planc., . . 136
Bulinella Newt., . . 287
Bullæformis Jeffr., . . 153
BULLA L., ... 327
Bullata Kn., . . . 183
Bullata Müll., . . . 377
Bullatus Gld., . . . 163
Bullea Blv., . . . 327
BULLIDÆ, ... 326
BULLINA Fér., . . 136, 175
Bullina Fér., . . . 391
Bullina Risso, . . . 287
Bullinula Gray, . . 391
Bullinula Sw., . . . 175
Bullus Montf., . . . 327
Bushii Dall, . . . 237

Cabrai Morl., . . . 401
Cælata Bush, . . . 232
Caledonica Morl., . . 409
Calyculata Sowb., . . 259
Canaliculata Fol., . . 407
Canaliculata Oliv., . . 377
Canaliculata Orb., . . 183
Canaliculata Say, . . 184
Canariensis Sm., . . 273
Cancellaris Ad., . . . 180
Candei Orb., . . . 185
Candida Br., . . . 284
Candida Pse., . . . 385
Candidula Ad., . . . 307
Candidula Loc., . . . 215

Candidus Br., . . . 283
Capitata Pils., . . . 195
Caribæa Orb., . . . 274
Carinata Cpr., . . . 187
Carpenteri Hanl., . . 302
Caron Hds., . . . 407
Casta Ad., . . . 172
Casta Cpr., . . . 276
Castanea Ad., . . . 374
Cecillii Ph., . . . 222
CEPHALASPIDEA, . . 134
Cerealis Gld., . . . 188
Cerina Mke., . . . 358
Ceylanica Brug., . . 378
Char Brug., . . . 244
Chariis Wats., . . . 174
Cheverti Braz., . . . 272
Chevreuxi Dautz., . . 291
Cincta Nev., . . . 383
Cinctella Ad., . . . 193
Cinctoria Perry, . . 388
Circulata Mart., . . 388
Cinerea Schr., . . . 350
Cinerea Wats., . . . 140
Cinulia Gr., . . . 394
Clausa Dall, . . . 338
Clavus Dall, . . . 246
Coarctata Ad., . . . 193
Coccinata Rv., . . . 143
Coleophysis Fisch., . 203
Columellaris Mke., . 344
Columnæ Chiaje, . . 333
Complanata Wats., . . 223
Compressa Roch., . . 334
Concentrica Ad., . . 314
Concinna Ad., . . . 172
Concinna Ad., . . . 309
Conformis Monts., . . 396
Consanguinea Sm., . . 313
Consobrina Ad., . . 305
Consobrina Gld., . . 308
Conspersa Pse., . . . 349
Constricta Ad., . . . 370
Conulus Sars, . . . 232
Conulus V., . . . 232
Convoluta Brocc., . . 290
Convoluta Schum., . . 245
Cornea Lam., . . . 353
Corticata Möll., . . . 291
Costulosa Pse., . . . 267
Cranchii Leach, . . 279
Crebripunctata Jeffr., . 293
Crebrisculpta Monts., . 211
Crispula Wats., . . . 315
Crocata Pse., . . . 363
Crossei B. D. D., . . 211
Cruentata Ad., . . . 345
Cubensis Gabb., . . 157
Culcitella Gld., . . . 189
Cumingi Ad., . . . 385
Cumingii Ad., . . . 162
Cumingii Ad., . . . 254
Cuneata Tib., . . . 212
Curta Ad., . . . 368
Curtulus Dall, . . . 163
Cuticulifera Sm., . . 372
Cuvieri Lch., . . . 353
Cryptaxis Jeffr., . . 287
CYLICHNA Lov., . 243, 287
CYLICHNELLA Gabb., 289, 325
CYLICHNINA Monts., . . 181
Cylindracea Penn., . . 289
Cylindrella Ad., . . 240
Cylindrella Sw., . . 287
Cylindrica Brug., . . 290
Cylindrica Cpr., . . 239
Cylindrica Helbl., . . 265
Cylindrica Sm., . . . 234
CYLINDROBULLA Fisch., 351, 379
Cymbalum Q. & G., . . 367
Cymbiformis Cpr., . . 360
Cymbulus Montf., . . 263
Cypraeola Mke., . . 350

Dactylis Mke., . . . 333
Dactylus Schum., . . 136
Dalli Ver., . . . 297
Danaida Dall, . . . 160
Darnleyensis Braz., . . 272
Debilis Gld., . . . 281
Debilis Pse., . . . 266
Decora Braz., . . . 371
Decussata Ad., . . . 315
Delicatula Ad., . . 190
Delicatus Dall, . . . 162

Denticulata Gld., . . 411
Dentifera Ad., . . . 276
Densa Braz., . . . 273
Densestriata Leche, . . 285
Desgenettii Aud., . . 311
Deshayesii Pils., . . 178
Diaphana Arad., . . 278
DIAPHANA Br., . 243, 280
Diaphana Couth., . . 356
Dianæ Ad., . . . 167
Dilatata Lch., . . . 355
Dilatatus Ad., . . . 255
DINIA Ad., . . 263, 276
Discors Schr., . . . 350
Discus Wats., . . . 299
Doliaris Gld., . . . 403
Domitus Dall, . . . 294
Donovani Lch., . . . 377
Dubiosa Braz., . . . 273

Eburnea Ad., . . . 239
Eburnea Dall, . . . 339
Eburnea Ver., . . . 298
Edentula Wats., . . 173
Elastica D. & S., . . 378
Elegans Ad., . . . 170
Elegans Ad., . . . 370
Elegans Ang., . . . 318
Elegans Authors, . . 354
Elegans Gray, . . . 355
Elegans Loc., . . . 378
Elegans Mke., . . . 392
Ellipsoidea Gld., . . 308
Elliptica, ... 231
Elongata Ad., . . . 265
Elongata Jeffr., . . . 294
Elongata Loc., . . . 291
Elongata Sow., . . . 172
Elongatus Ad., . . . 254
Encarpoferens Fol., . . 407
Esther Ang., . . . 170
Eucampe Lcb., . . . 376
Eumicra Cr., . . . 227
Eumicrus Cr., . . . 227
Exarata Ad., . . . 168
Exarata Cpr., . . . 343
Exarata Ph., . . . 362
Excavatus Jeffr., . . 214
Exigna Ad., . . . 270
Exiguus Dkr., . . . 161
Exilis Dkr., . . . 190
Exilis Jeffr., . . . 156
Eximea Bd., . . . 189
Eximia Dh., . . . 393
Expansa Jeffr., . . . 284
Expansa Monts., . . 353
Exserta Hds., . . . 408

Fabreanus Cr., . . . 150
Famelicus Wats., . . 225
Fasciata Lam., . . . 153
Fasciata Sowb., . . . 259
Fasciatum Schum., . . 390
Fasciatus Dall, . . . 163
Ferruginea Sowb., . . 369
Ferruginosa Ad., . . 263
Ferruginosa Perry, . . 389
Ferussaci Dh., . . . 393
Fijiensis Sm., . . . 321
Filosa Schum., . . . 387
Fischeri Ad. & Ang., . 381
Flammeus Gm., . . 151
Flavescens Ad., . . . 374
Flexilis Brn., . . . 377
Folini Morl., . . . 406
Folliculus Ad., . . . 230
Folliculus Mke., . . 354
Follini, ... 406
Fossulata Fol., . . . 409
Fourieri Aud., . . . 312
Fragilis Jeffr., . . . 380
Fragilis Lam., . . . 377
Fragilis Pse., . . . 384
Fraterculus Dkr., . . 138
Freyi Branc., . . . 264
Frielei Dall, . . . 219
Fucicola Chier., . . 234
Fulgida Ad., . . . 363
Fumata Rv., . . . 145
Fusca Ad., . . . 369
Fusiformis Ad., . 192, 194

Galba Pse., . . . 364
Gemma Ver., . . . 339
Gibbulus Jeffr., . . 278
Gigantea Dkr., . . . 167

Giganteus Risso, . . 245
Giœnia Brug., . . 244
Gioeni Gio., . . 244
Glabra Ad., . . 356
Glabra Rv., . . 143
Glauca Ad., . . 258
Glauca Q. & G., . 259
Glauconella Gr., . 257
Globosa Cantr., . . 284
Globosa Cantr., . . 378
Globosa Jeffr., . . 285
Globosa Jeffr., . . 353
Globosa Lov., . . 286
Globulinus Fbs., . . 155
Goujoni Fol., . . 409
Gouldiana Pils., . 340
Gouldii Couth., . . 217
Gracilis Ad., . . 194
Gracilis Kirk, . . 146
Gracilis Mke., . . 187
Gracilis Wats., . . 247
Grandinosa Hds., . 409
Granosa Braz., . . 324
Granulum Phil., . 309
Grateloupii Mich., . 245
Grimaldi Dautz., . 291
Grisea Sm., . . 362
Guadalupensis Sowb., . 358
Guamensis Q. & G., . 392
Guernei Dautz., . . 336
Guildingii Sw., . . 356
Guildinii Sowb., . 274

Haminœa Lch., . . 352
Haminea Lch., . 351, 352
Hamineinæ Pils., . 351
Hanleyi Ad., . . 377
Harpa Dall, . . 186
Hebes V., . . 159
Hiemalis Couth., . 286
Hoernesi Wkf., . . 212
Hofmani Ang., . . 203
Hordacea Sowb., . 270
Hordeacea Ad., . . 270
Huttoni Kirk, . . 147
Hyalina Gmel., . . 354
Hyalina Turt., . . 283
Hyalina Wats., . . 271
Hydatina Schum., . . 386
Hydatinidæ, . . . 385
Hydatis Brug., . . 353
Hydatis L., . . 354

Ibyx Meusch., . . 330
Incisus Dall, . . 160
Incommoda Sm. . . 347
Inconspicua Ad, . . 192
Inculta Cpr., . . 188
Inedita Ad., . . 307
Inflata Dkr., . . 389
Infrequens Ad., . 187
Insculpta Ad., . . 169
Insculpta Rv., . . 139
Insculpta Tot., . . 357
Insculpta V., . . 156
Intermedia Ang., . 145
Intermedia Arad., . 279
Interruptus Dall, . 250
Involuta Ad., . . 310
Involuta Ph., . . 228
Involuta Nev., . . 196
Isseli H. Ad., . . 369
Issellii Pils., . . 191

Japonica Ad., . . 169
Japonica Ad., . . 304
Japonicus Ad., . . 254
Jeffreysi Loc., . . 278
Jeffreysi Weink., . 277

Kirki Hutt., . . 146
Kleinella Ad., . 136, 179
Knockeri Sm., . . 183
Krebsii Dall, . . 337
Krebsi Mörch., . . 300

Labiata Wats., . . 313
Labiosa Phil., . . 269
Lactea Jeffr., . . 213
Lacteocincta Sm., . 322
Lactuca Nev., . . 196
Læta Gld., . . . 308
Lævisculpta Gr., . 211
Lagenula Ad., . . 230
Lajonkaireana, . . 215

Latiuscula Ad., . . 305
Lauta Ad., . . . 172
Lauta Pse., . . . 177
Lepidula Ad., . . . 305
Leptekes Wats., . . 200
Leptocheila Brugn., . . 399
Leucotina Ad., . 136, 166
Leucus Wats., . . . 208
Librarius Lovén, . . 246
Ligata Schr., . . . 350
Lignarius L., . . . 245
Linearis Jeffr., . . . 290
Lineata Gr., . . . 177
Linteria Ad., . . . 258
Liratispira Sm., . . 185
Lottæ Bush., . . . 281
Lucida Ad., . . . 363
Luteofasciatus Mhl., . . 155
Luticola Ad., . . . 302
Lyrata Cpr., . . . 168

Macandrewii Sm., . . 273
Maculosa Mart., . . 330
Magdelus Ang., . . . 350
Malleata Sm., . . . 374
Mamillata Ph., . . . 206
Mammillata Ph., . . 207
M'Andrewii Sm., . . 272
Mappa Schr., . . . 350
Mariæ Ad., . . . 148
Mariæ T.-W., . . . 198
Mariei Dautz., . . . 207
Mariei Morl., . . . 404
Marginata Mke., . . 330
Marmorata Ad., . . 323
Marmorea Pse., . . 348
Marmorea Schr., . . 350
Mayoi Dall, . . . 219
Media Phil., . . . 330
Meekii Dall, . . . 178
Melampoides Dall, . . 158
Melampoides Gld., . . 309
Mica Ehr., . . . 311
Micromelo Pils., . 386, 391
Minor Ad., . . . 259
Minor Dkr., . . . 334
Minor Jeffr., . . . 215
Minuta Ad., . . . 312
Minuta Ad., . . . 405
Minuta Braz., . . . 315
Minuta Brown, . . 283
Minuta Bush, . . . 237
Minuta Mcgill . . . 207
Minuta Sm., . . . 171
Minutissimus Mar., . . 215
Minutus Pet., . . . 149
Miranda Sm., . . . 277
Mnestia Ad., . . 289, 323
Modesta Ad., . . . 170
Mongii Aud., . . . 311
Monodonta Ad., . . 276
Monoptygma Ad., . . 166
Monterosatoi Dautz., . . 155
Moritzi Fol., . . . 402
Mucronata Ph., . . 191
Multistriata Ad., . . 330
Multistriatus Braz., . . 252
Mundus Wats., . . 251
Muscaria Gld., . . 264
Myonia Ad., . . . 166

Natalensis Kr., . . 367
Natalensis Sby., . . 361
Naucum L., . . . 263
Naucum Schum., . . 261
Navicula Da C., . . 353
Nebulosa Gld., . . 340
Nebulosa Schr., . . 350
Nigropunctata Pse., . . 365
Niphonensis Ad., . . 168
Nitida Ad., . . . 230
Nitida Ver., . . . 399
Nitidula Lam., . . 144
Nitidula Lov., . . 212
Nitidula Sowb., . . 392
Nitidus V., . . . 156
Nitens Sm., . . . 321
Nivea Ang., . . . 146
Nivea Petterd., . . 286
Nivens Wats., . . . 252
Nobilis V., . . . 249
Nona Ad., . . 243, 261
Nonscripta Ad. . . . 268
Noronyensis Wats., . . 301
Norvegica Brug., . . 377
Notaspidea, . . . 134

Noumeensis Morl., . . 410
Novæeboraci Sowb., . . 357
Nucleola Rv., . . . 291
Nux DaC., . . . 327
Nux Mke., . . . 332

Obesiuscula Brugn., . . 231
Obesus Jeffr., . . . 214
Oblonga Ad., . . . 346
Oblonga Mke., . . . 144
Obovata Mke., . . . 264
Obstricta Gld., . . . 184
Obtusa Brn., . . . 205
Obtusa Mtg., . . . 214
Occidentalis Ad., . . 331
Occulta Migh., . . 292
Oelertiana Morl., . . 404
Omphalis Mörch, . . 221
Omphalodes Mke., . . 333
Olivæformis Iss., . . 191
Oliva Gmel., . . . 290
Oliva Kl., . . . 287
Oliviformis Wats., . . 207
Olivula Ad., . . . 183
Opalina Ad., . . . 239
OPISTHOBRANCHIATA, . 134
Oporosa Gld., . . . 308
Orbignyana Fér., . . 354
Ordinaria Sm., . . 319
Oryctus Wats., . . 227
Oryza Gabb., . . . 166
Oryza Rv., . . . 151
Oryza Tott., . . . 325
Ovalis DaC., . . . 153
Ovalis Mch., . . . 161
Ovalis Pse., . . . 365
Ovata Jeffr., . . . 232
Ovoidea Ad., . . . 263
Ovoidea Mke., . . . 373
Ovoidea Q. & G., . . . 366
OVULACTÆON Dall, . 136, 178
Ovula (Gld.) Sowb., . . 349
Ovulata Brocc., . . 277
Ovulata Jeffr., . . 277
Ovulina Ad., . . . 240
Ovulum Pfr., . . . 165
Oxytata Bush., . . 235

Pachys Wats., . . 198
Panamensis Ph., . . 343
Papyrus Ad., . . . 371
Parallela Ad., . . . 306
Parallela Gld., . . 266
Parvula Ad., . . . 270
Parvula Jeffr., . . 293
Passieri Morl., . . 398
Paupercula Wats., . . 238
Peasiana Pils., . . 348
Pellucida Brown, . . 206
Pellucidus Br., . . 283
Pellyi Sm., . . . 231
Pemphis Ad., . . . 374
Pemphis Ph., . . . 368
Pemphix Sowb., . . 374
Pennata Schr., . . . 350
Peracuta Wats., . . 400
Perconicus Dall, . . 165
Perdicina Mke., . . 335
Perforata Phil., . . 370
Perforatus Dall, . . 159
Perplexa Sm., . . . 375
Perplicata Dall, . . 217
Perpusilla Sm., . . 312
Persiana Sm., . . . 190
Persimilis Mch., . . 236
Perstriata Mke., . . 332
Pertenuis Migh., . . 216
Pertenuis Sm., . . . 307
Peruviana Orb., . . 361
Pervius Dall, . . . 220
Petersi Mart., . . . 368
Petitii Orb., . . . 359
Phiala Ad., . . . 230
Philine Asc. . See Vol. xvi.
Physema Ad., . . . 280
Physis L., . . . 387
Pinguicula Jeffr., . . 339
Piriformis Pse., . . 384
Pisum Chiaje, . . . 354
Planata Cpr., . . . 302
Planospira Ad., . . 192
Polita Ad., . . . 192
Porcellana Gld., . . 268
Prismatica Fol., . . 406
Producta Br., . . . 290
Propinquans Hds., . . 408

Propinqua Sars, . . 292
Propinqua Sm., . . 303
Protracta Dtz., . . 182
Protracta, Gld., . . 309
Proxima Ad., . . 304
Pudicus Ad., . . . 150
Pulchella Jeffr., . . 398
Pulchella Sw., . . 390
Pulchra Braz., . . 272
Pulverulenta Schr., . . 350
Pulvisculus Ehr., . . 311
Pulvisulcus Ad., . . 311
Pumila Ad., . . . 306
Pumilissima Sm., . . 313
Punctata Ad., . . 169
Punctata Ad., . . 341
Punctata Fér., . . 143
Punctata Orb., . . 157
Punctata Schr., . . 350
Punctocælata Cpr., . . 166
Punctostriatus Ad., . . 157
Punctostriatus Migh., . 246
Punctosulcata Sm., . . 324
Punctulata Ad., . . 279
Punctulata Ad., . . 341
Punctura Johns., . . 279
Puncturata Sm., . . 172
Pupillus Monts., . . 156
Pura Ad., . . . 172
Purpurea Schr., . . 350
Pusilla Ad., . . . 139
Pusilla Iss., . . . 191
Pusilla Nev., . . . 382
Pusilla Pfr., . . . 185
Pusilla Pse., . . . 364
Pusilla Wats., . . . 412
Pusillus Fbs., . . . 156
Pusillus Jeffr., . . 214
Pygmæa Ad., . . . 319
Pyramidata Ad., . . 310
Pyriformis Ad., . . 229
Pyriformis Monts., . . 205
Pyriformis Pse., . . 383
PYRUNCULUS Pils., . 181, 229

Quadrata Monts., . . 284
Quoyana Orb., . . 387
Quoyi Ad., . . . 341
Quoyi Gray, . . . 348

Radiola Ad., . . . 240
Recta Orb., . . . 184
Reevei Smith, . . . 413
Regularis Gld., . . 318
Reinhardi Holb., . . 292
Resiliens Don., . . 377
Reticulata Wats., . . 316
RETUSA Brown, . 181, 203
Retusa M. & R., . . 205
Rhizorus Montf., . . 233
Richardi Dautz., . . 293
RICTAXIS Dall, . 148, 166
Riiseana Dkr., . . 275
Rimata Ad., . . . 305
RINGICULA Dh., . . 394
RINGICULIDÆ, . . 393
Ringiculina Monts., . 394
Robagliana Fisch., . 213
Roperiana Pils., . . 336
Rostrata Ad., . . 241
Rotunda Sowb., . . 375
Rotundata Ad., . . 375
ROXANIA Leach., . 262, 279
ROXANIELLA Monts., . 263
Rubicunda Schr., . . 345
Rubiginosa Gld., . . 330
Rufescens Schr., . . 350
Rufolabris Ad., . . 342
Rugosa Sm., . . . 369
Rüseana Dkr., . . . 275

SABATIA Bell., . 243, 255
Salleana Morl., . . 397
Sandersoni Dall, . . 275
Sandwicensis Pse., . . 190
Sandwichensis Sby., . . 365
Sao Ad., . . . 229
Sarsii (Ph.) Ad., . . 322
Savignyana Gr., . . 368
Savignyi Morl., . . 405
Scabra Gm., . . . 176
Scalpta Rv., . . . 292
SCAPHANDER Montf., 243, 244
SCAPHANDRIDÆ, . . 242
Schlumbergeri Morl., . 396
Scitula Ad., . . . 170
Scrobiculata Ad., . . 265
Sculpta Nev., . . 381
Secale Gld., . . . 149

Secalina Ad., . . 269
Seguenzæ Wats., . 282
Semen Rv., . . 216
Semilævis Seg., . 337
Seminulum Ph., . 229
Semisculptus Sm., . 152
Semistriata Orb., . 399
Semistriata Pse., . 267
Semistriata Req., . 278
Semisulcata Dkr., . 303
Semisulcata Ph., . 206
Senegalensis Malz., . 172
Senegalensis Morl., . 402
Senegalensis Pet., . 152
Serica Sm., . . 375
Sicula Brug., . . 245
Siebaldii Rv., . . 148
Sieboldi Ad., . . 260
Sieboldii Ad., . . 255
Simillima Pse., . 366
Simillima Wats., . 226
Simplex Ad., . . 193
Sinensis Ad., . . 362
Singaporensis Pils., . 194
Sinuata Ang., . . 171
Smaragdina Ad., . 261
SMARAGDINELLA Ad., 243, 257
Smithii Pils., . . 233
Solida Ang., . . 347
Solida Brug., . . 266
Solida Brug., . . 335
Solidula L., . . 142
SOLIDULA Waldh., . 136
Solitaria Say, . . 357
Soluta Gmel., . . 378
Someri Fol., . . 402
Souverbiei Montr., . 381
Spatha Wats., . 218
Speciosa Ad., . . 172
Speciosa Ad., . . 275
Spectabilis Ad., . 240
Speo Risso, . . 147
Splendens Mke., . 350
Splendidulus Mch., . 161
Staminea Mke., . 388
Striata Br., . . 292
Striata Brug., . . 332
Striata Hutt., . . 319
Striata Orb., . . 330
Striata Q. & G., . 348
Striata Risso, . . 206
Striatula Ad., . . 239
Striatula Fbs., . . 212
Striatulum Schum., . 261
Strigella Ad., . . 314
Strigella Lov., . 211
Strigosa Ad., . . 362
Strigosa Gld., . . 137
Subangulata Möll., . 281
Subcylindrica Br., . 211
Sublignarius Orb., . 245
Subpellucida Ad., . 353
Subreticulata Wats., . 317
Subrotunda Jeffr., . 337
Substriata Jeffr., . 214
Substriata Mke., . 346
Subulata Wood, . 153
Succincta Ad., . 222
Succinea Con., . 357
Succisa Ad., . . 266
Succisa Ehr., . . 267
Sulcata Ad., . . 168
Sulcata Ad., . . 180
Sulcata Gmel., . 143
Sulcata Mke., . . 331
Sulcata Orb., . . 221
Sulcata Wats., . 241
Sulcatinus Ad., . 254
Suturalis Ad., . . 139
Suturalis Sm., . . 401

Tahitensis Wats., . 320
Targionius Risso, . 245
Tasmanica Bedd., . 379
TECTIBRANCHIATA, . 134
Tenella Ad., . . 368
Tenella Lov., . . 153
Tenera Ad., . . 371
Tenuicula Mke., . 332
Tenuis Ad., . . 378
Tenuissima Sby., . 347
Teres Phil., . . 196
Terquemi Morl., . 396
Tessellata Rv., . 140
Textilis Gupp., . 162
Thalassiarchi Mart., . 390

Thecaphorus Nutt, . . 258
Tigris Schr., . . . 350
Tornata Wats., . . 209
Tornatella Lam., . . 147
Tornatilis L., . . . 152
TORNATINA Ad., . . 181
TORNATINIDÆ, . . 180
Tortuosa Ad., . . 264
Translucens Ad., . . 269
Tricla Phil., . . . 244
Trifasciata Sowb., . . 344
Triticea Blv., . . 278
Triticea Couth., . . 291
Truncata Ad., . . . 205
Truncatella Loc., . . 206
Truncatula Brug., . . 205
Tubulosa Gld., . . 321
Tumida Ad., . . . 379
Turgidula Fbs., . . 278
Turrita Möll., . . 215
Turritus Wats., . . 157

Umbilicata Mont., . . 210
Undata Ad., . . . 177
Undata Brug., . . 392
Undulata Fér., . . 393
Utriculus Brn., . . 203
Utriculus Brocc., . . 279

Vagabunda M. & R., . 164
Variegatus Brug., . . 151
Velum Gmel., . . 388
Ventricosa Jeffr., . . 284
Ventrosus Jeffr., . . 285
Venustula Ad., . . 304
Venustus Orb., . . 164
Vernicosa Gld., . . 349
Verrillii Dall, . . 298
Vesica Swains, . . 327
Vesicula Gld., . . 359
Vexillum Chemn., . . 388
Vigourouxi Montr., . 383
Villica Gld., . . 307
Villiersi Aud., . . 312
Villosa Mart., . . 344
Viridis Rang., . . 258
Virgata Martyn, . . 387
Virgatus Rv., . . . 151
Virescens Sby., . . 360
Vitrea Ad., . . . 370
Vitrea Dh., . . . 178
Vitrea Pse., . . . 177
Vitrea Sars., . . . 286
Voluta Q., . . . 195
VOLVATELLA Pse., . 351, 382
VOLVATELLINÆ Pils., . 351
VOLVULA Ad., . . 181, 233
Volvulella Newt., . . 233
Volvulina Ad., . . 270
Vortex Dall, . . . 295

Wallisii Gray, . . 373
Watsoni Dall, . . 248
WEINKAUFFIA Ad., Monts., 263

Zealandiæ, . . . 374
Zealandica Kirk, . . 320
Zelandiæ Gray, . . 373
Ziczac Mühl, . . . 176

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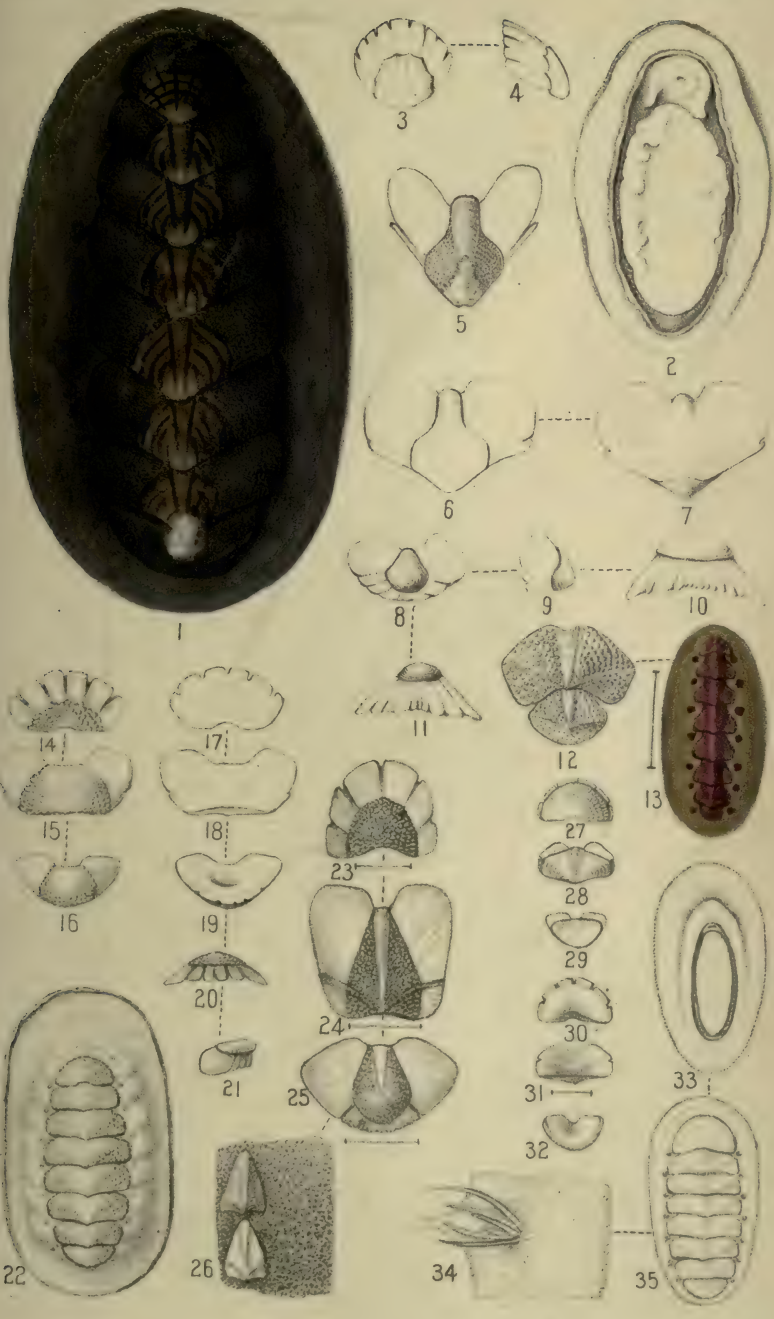
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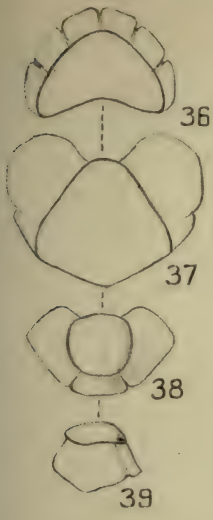
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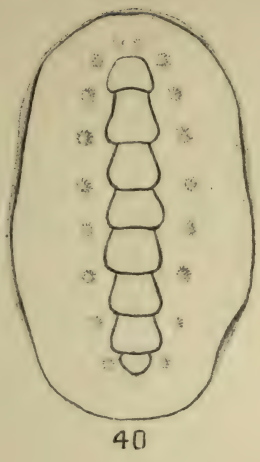
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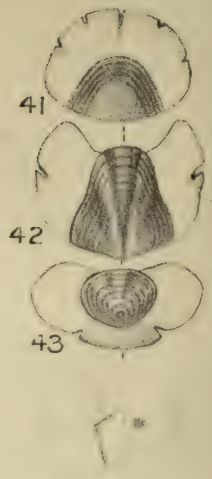
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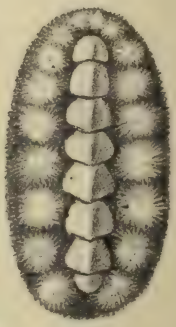
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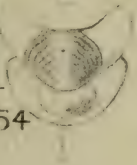
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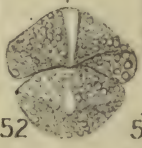
52

56

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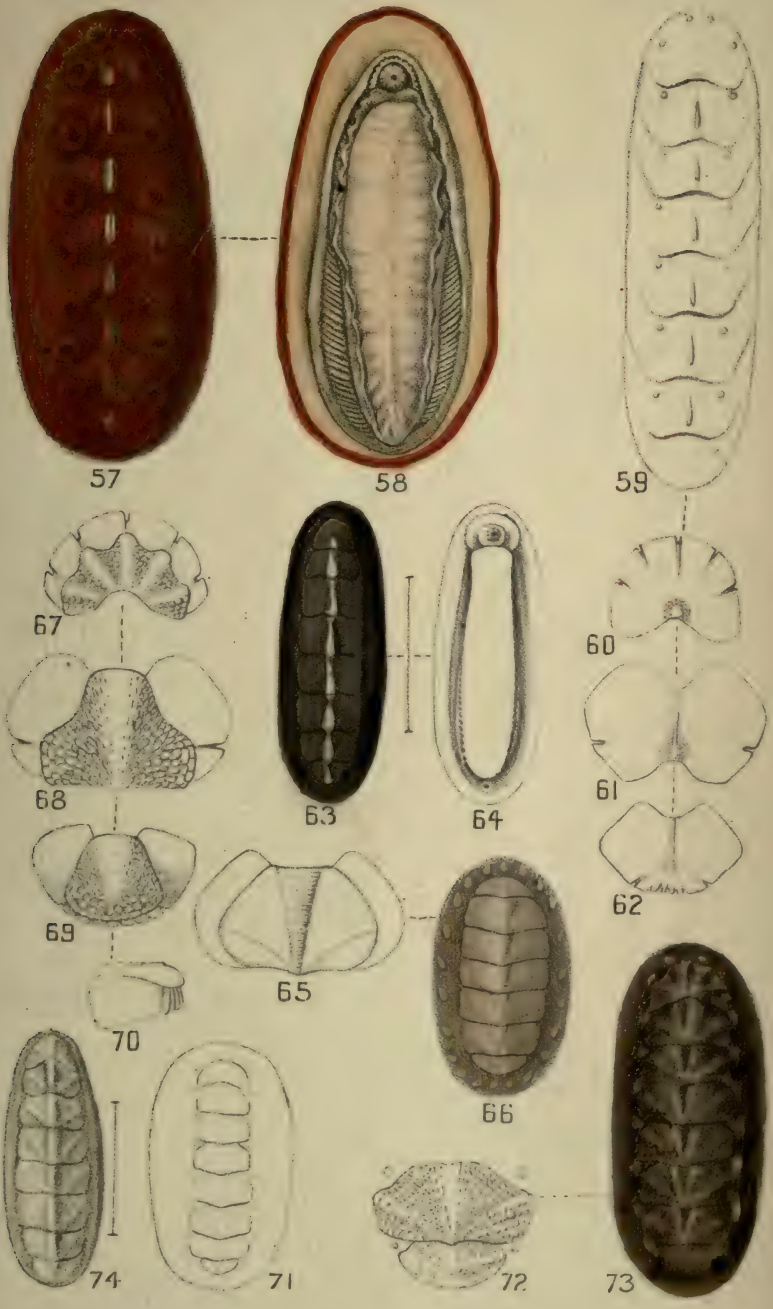
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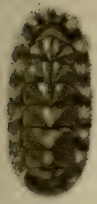

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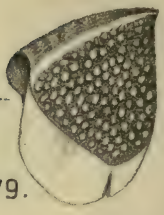

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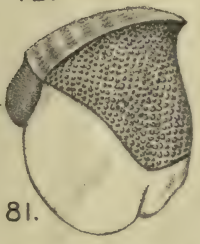

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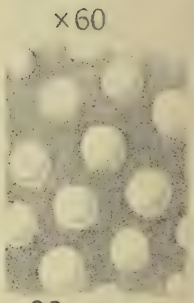

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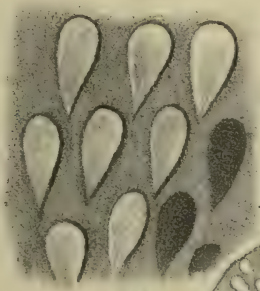

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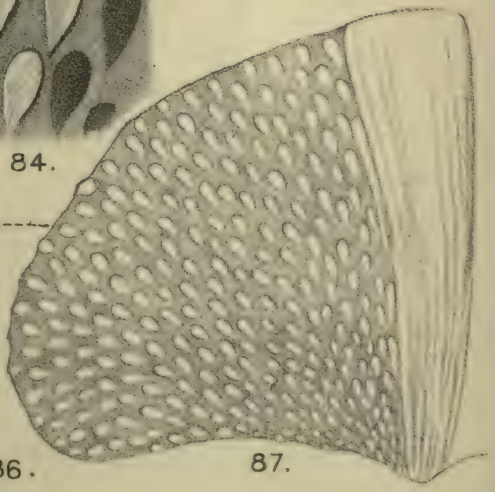

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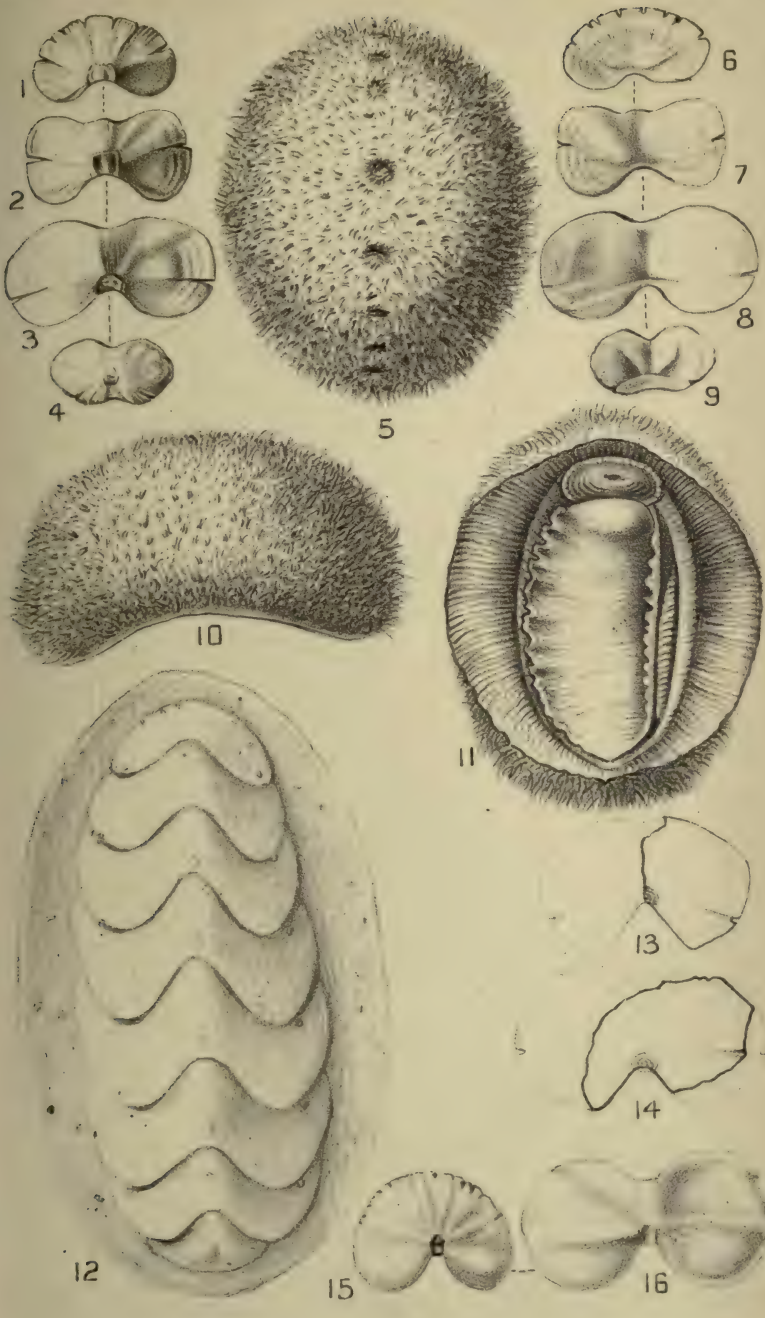
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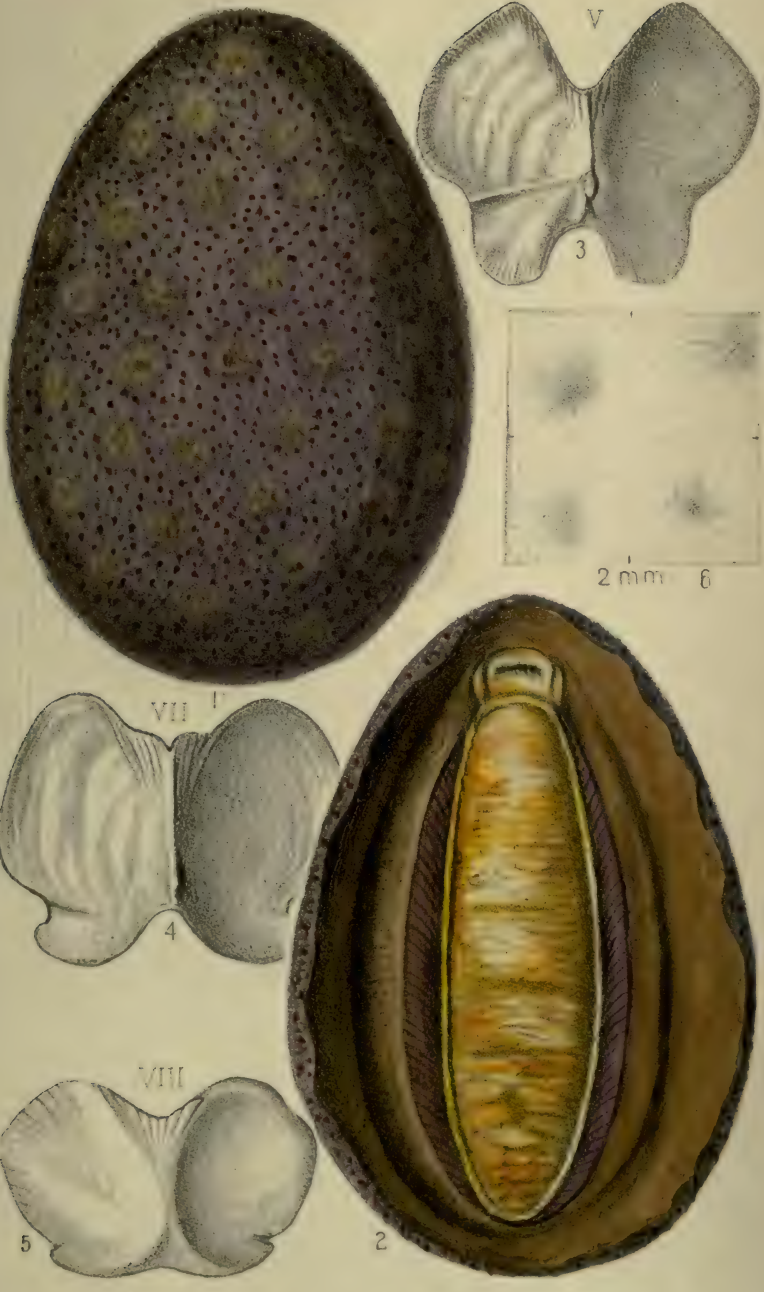
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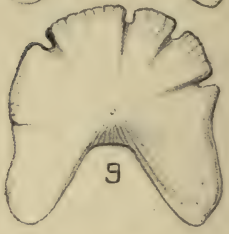

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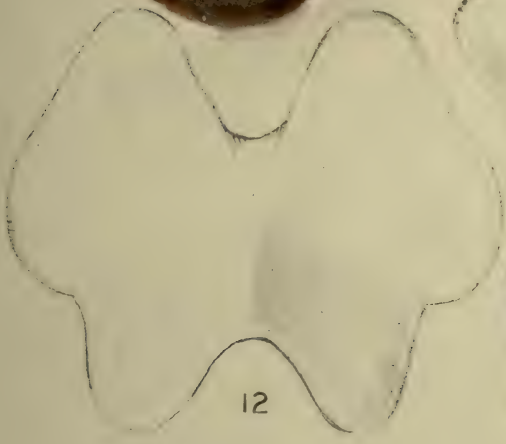

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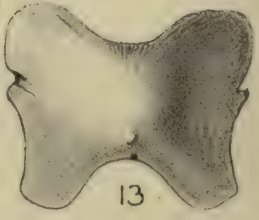

13

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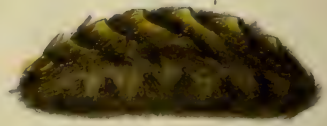
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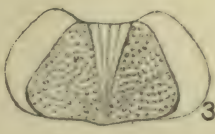
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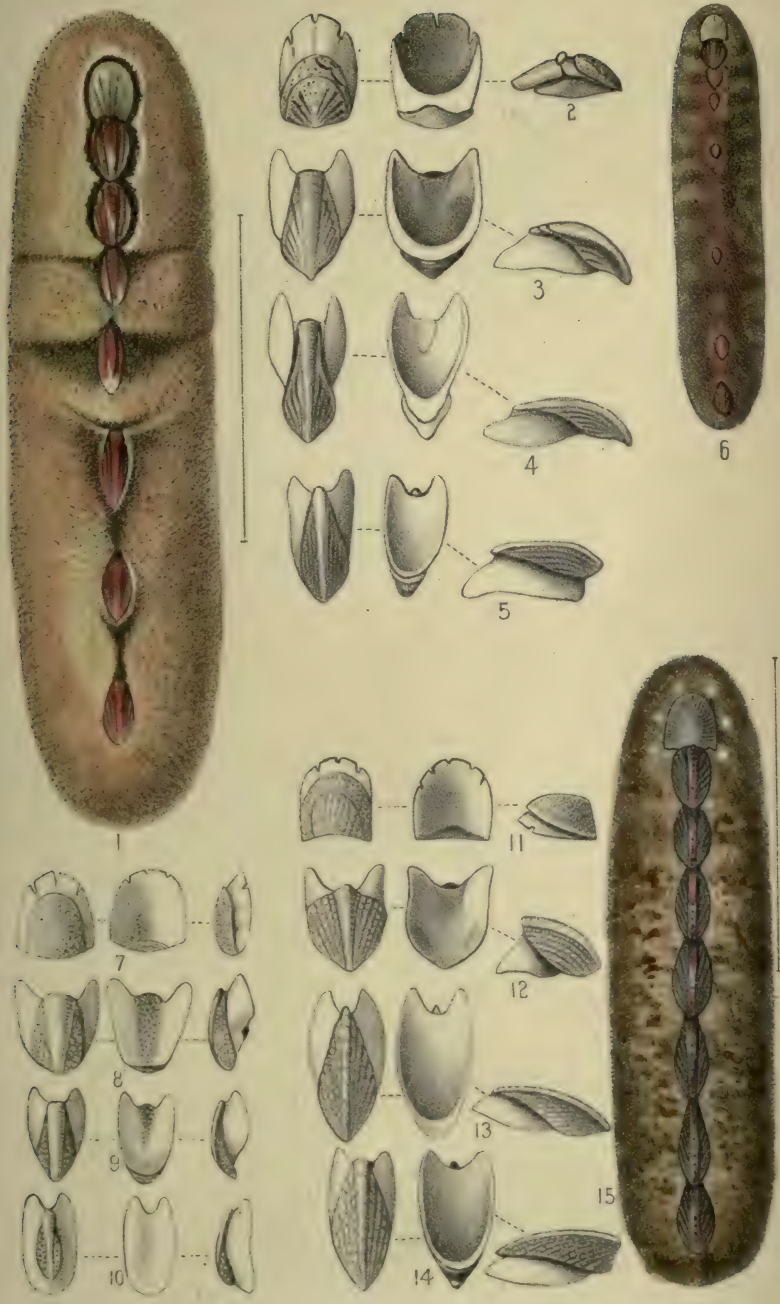
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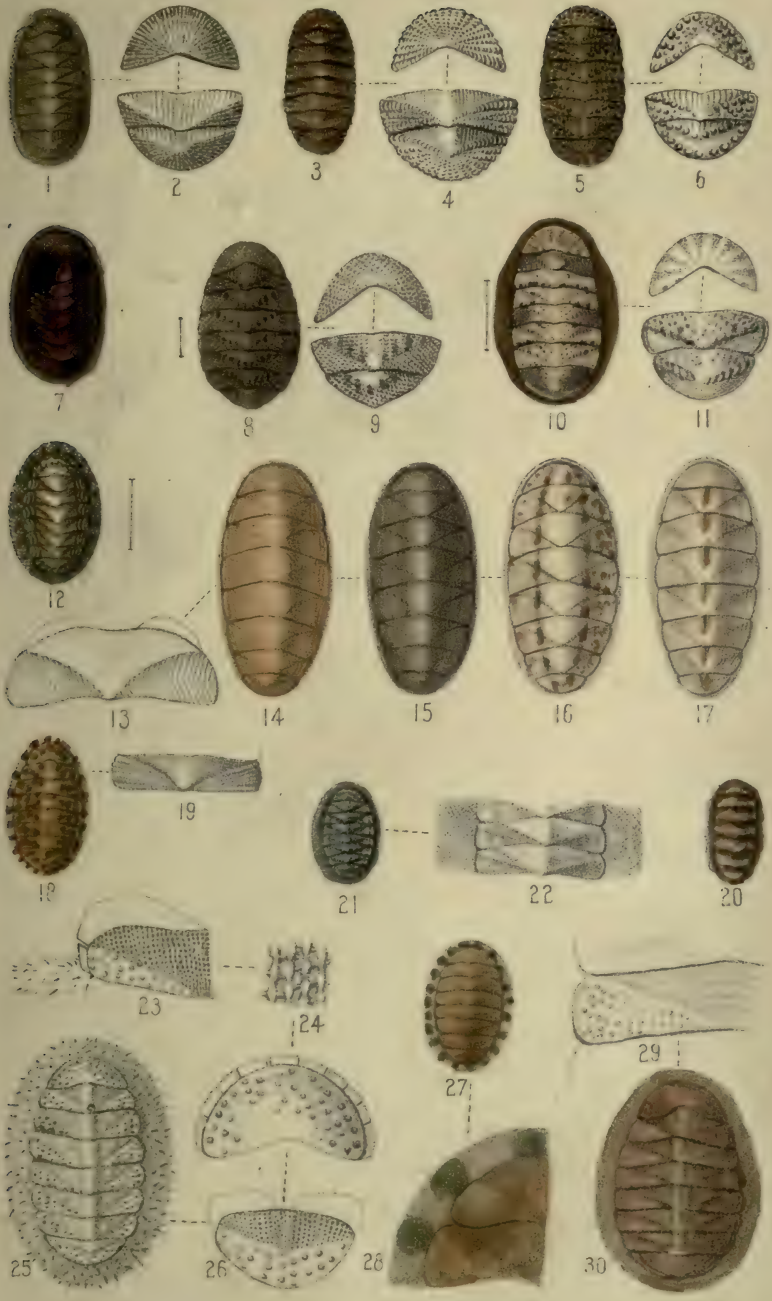
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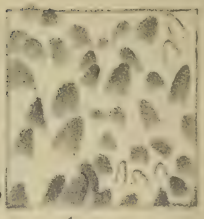
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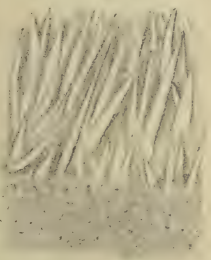
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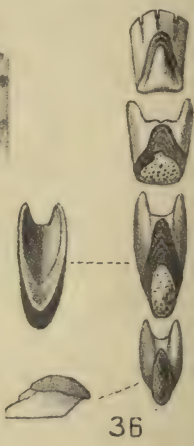
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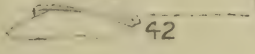
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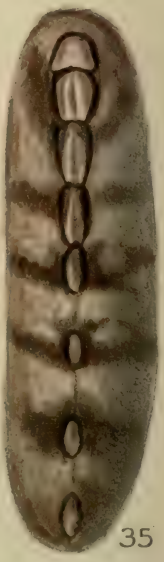
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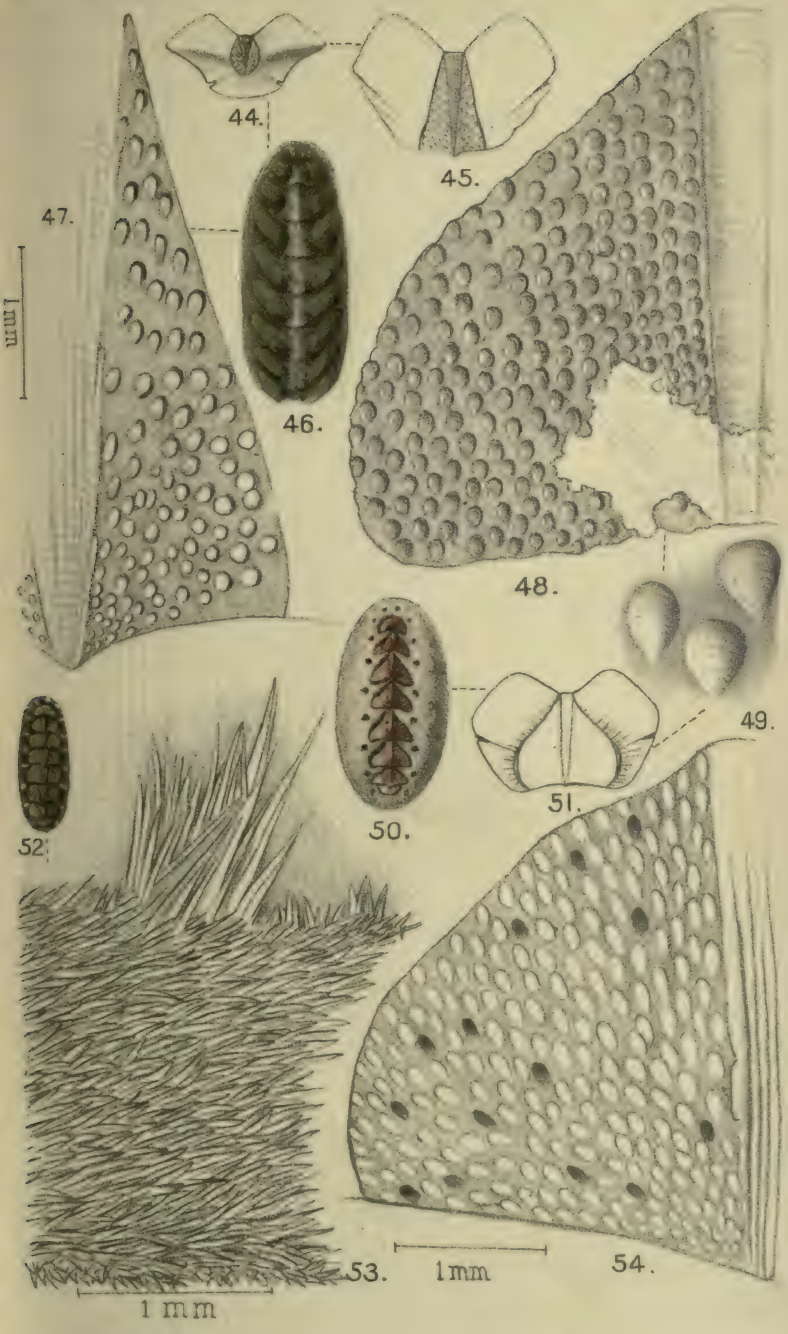
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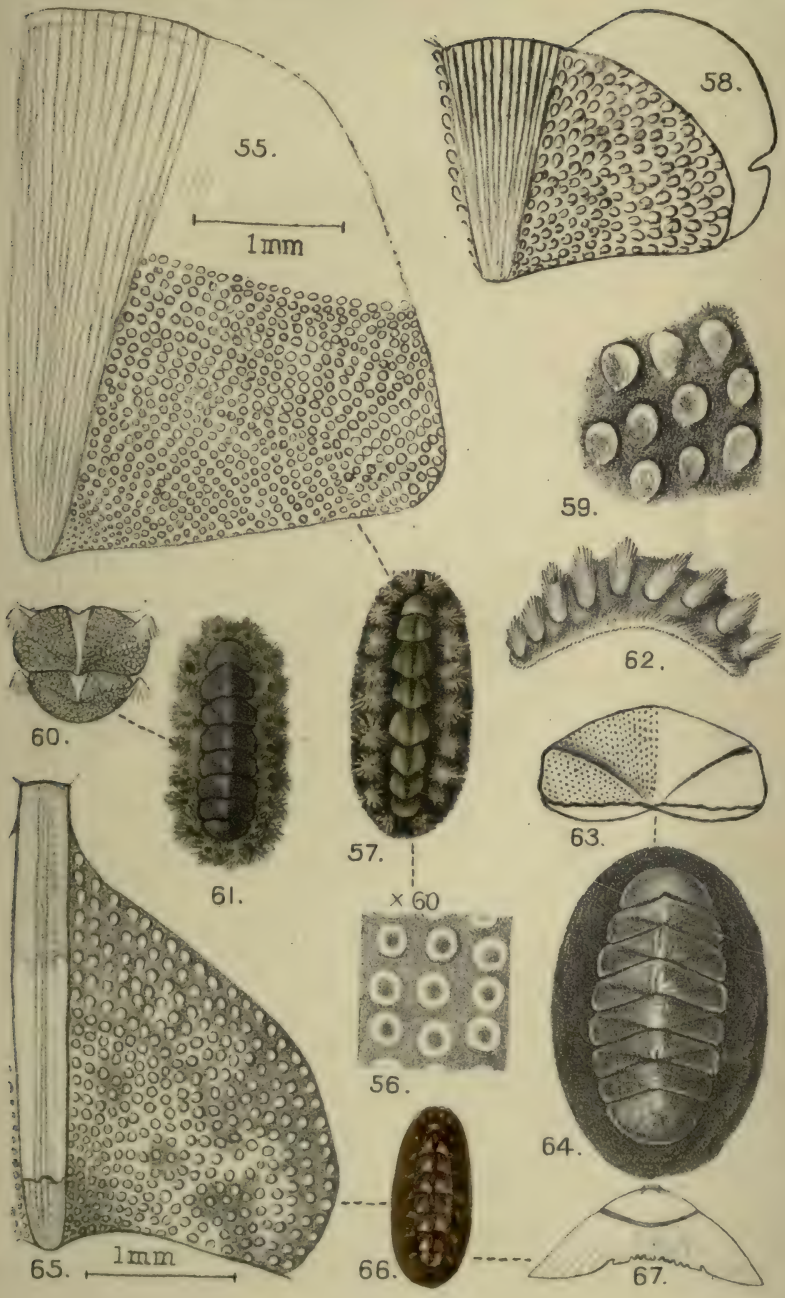
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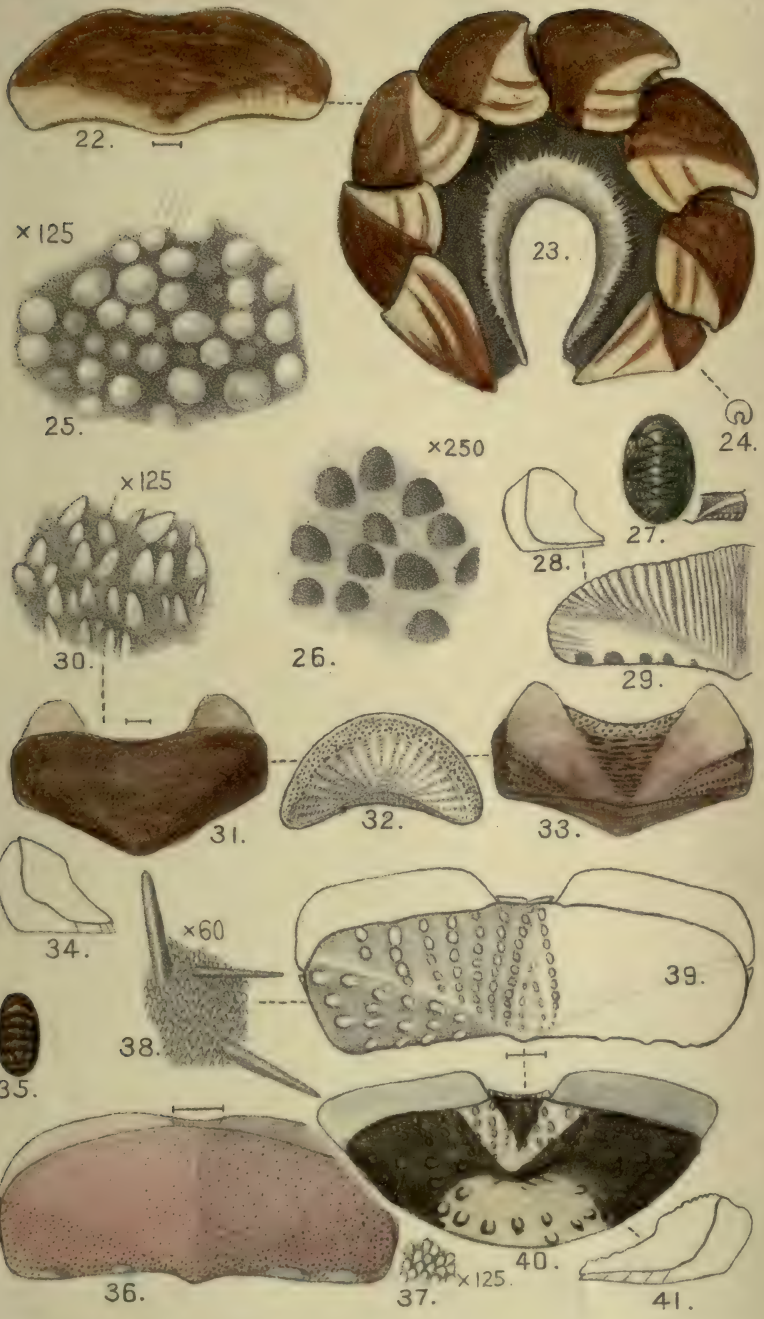
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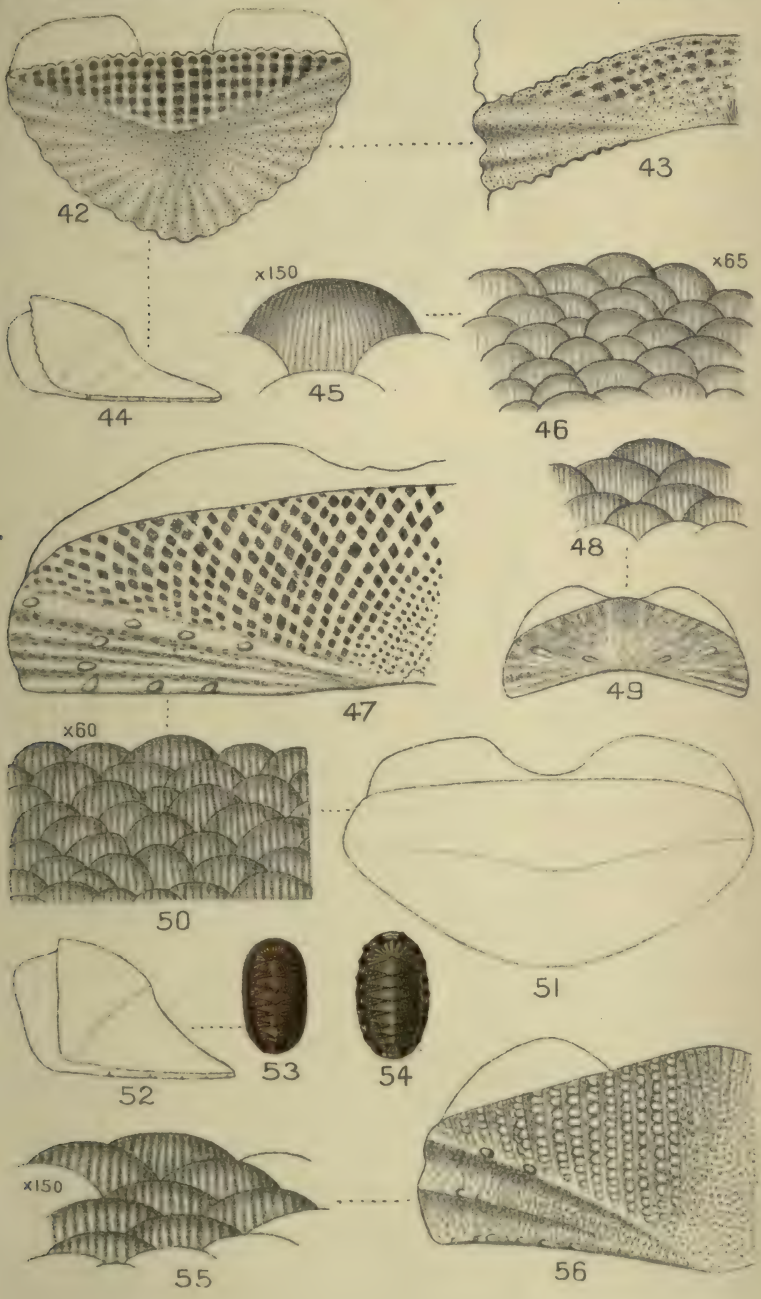
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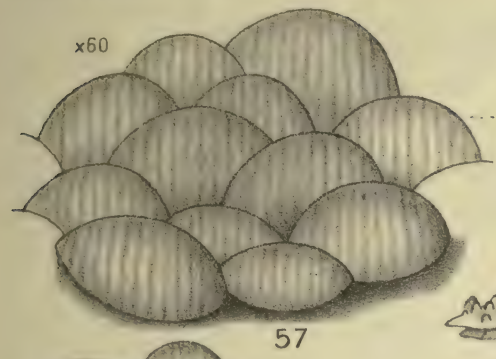

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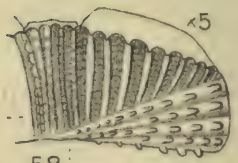

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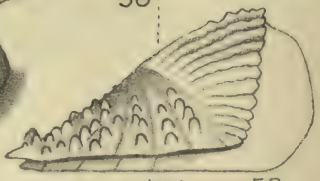

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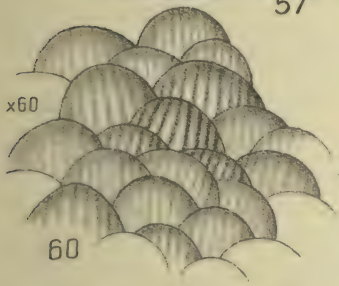

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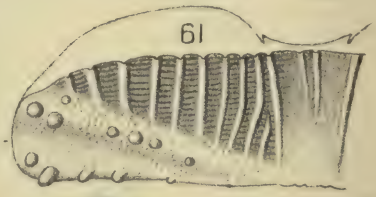

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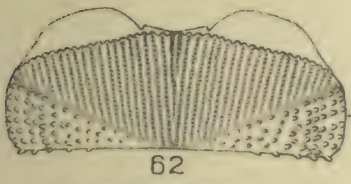

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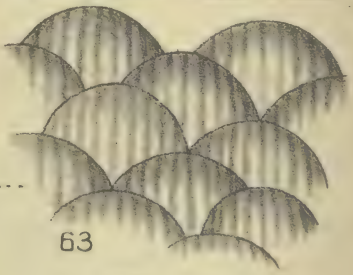

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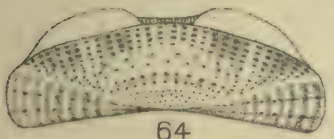

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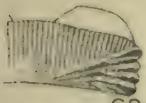

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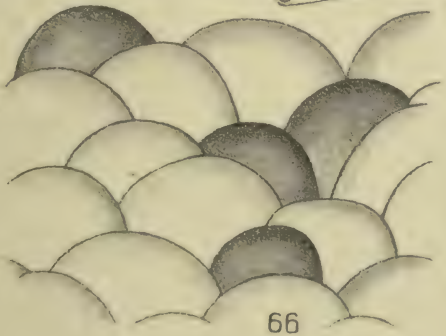

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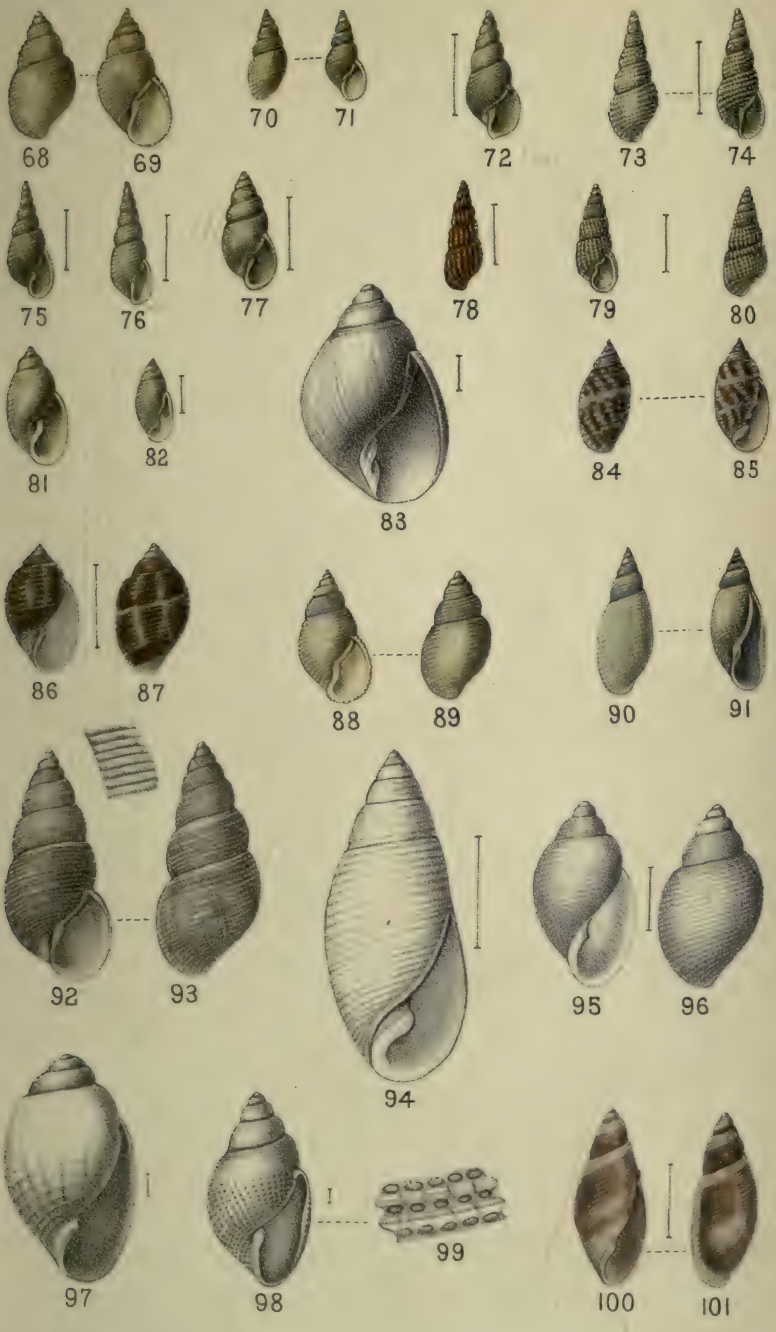
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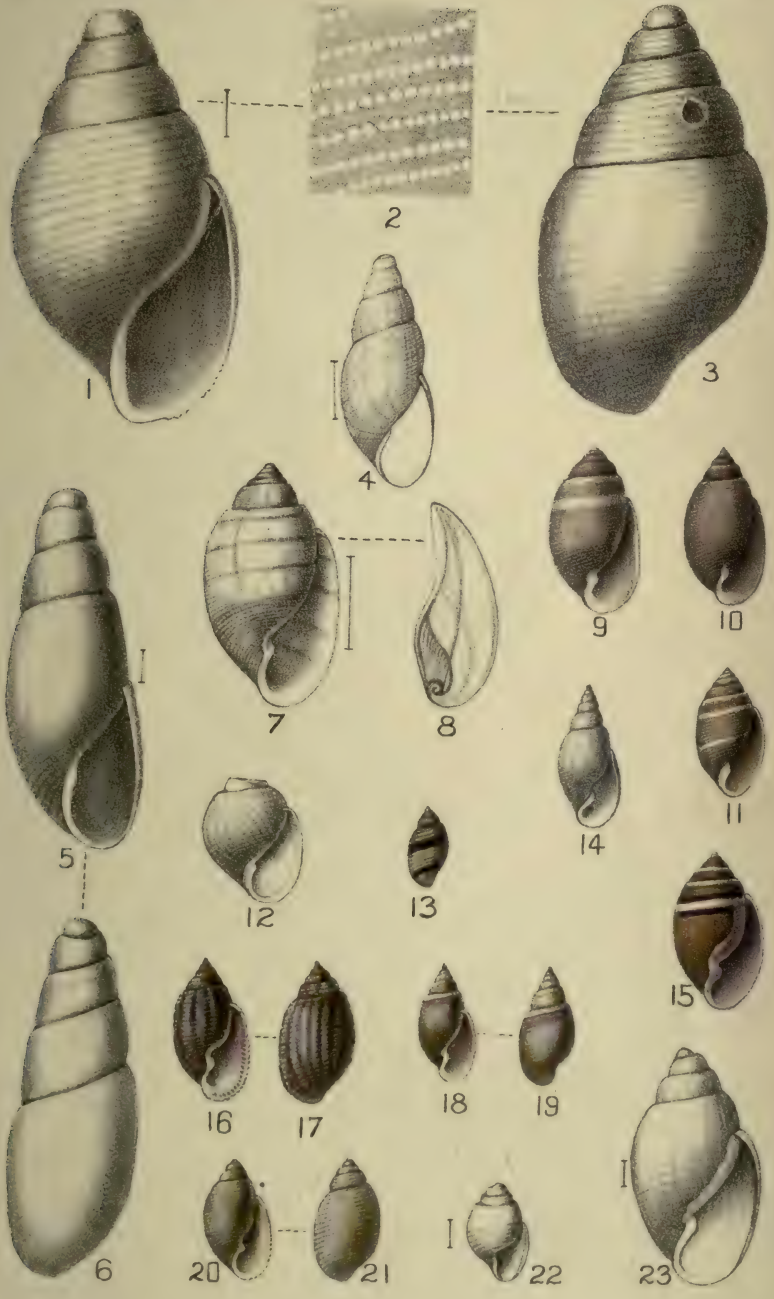
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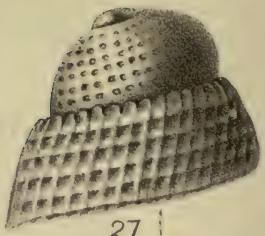
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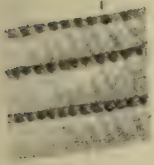
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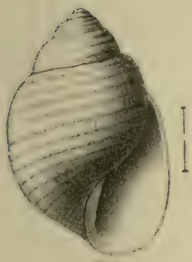
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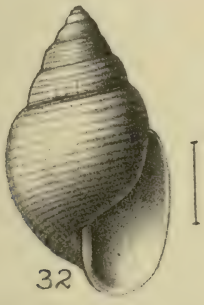
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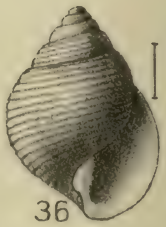
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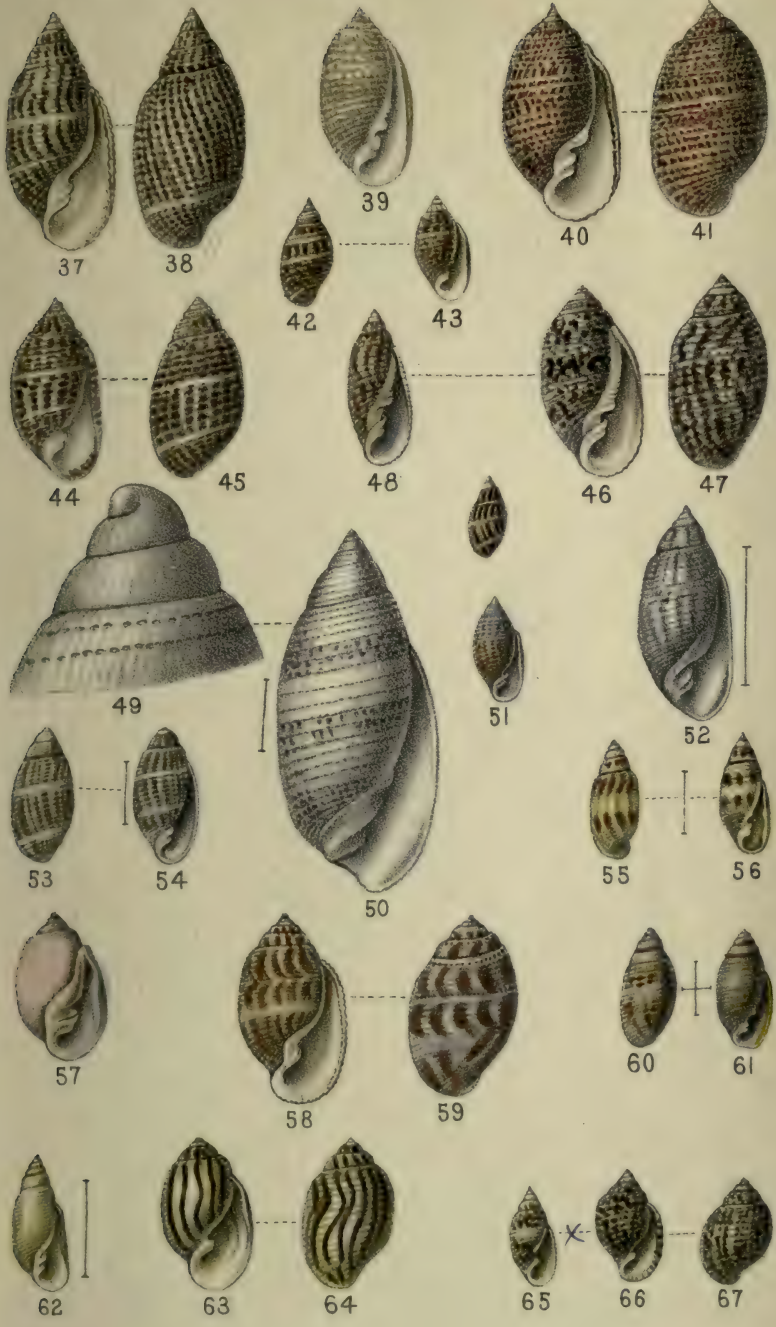
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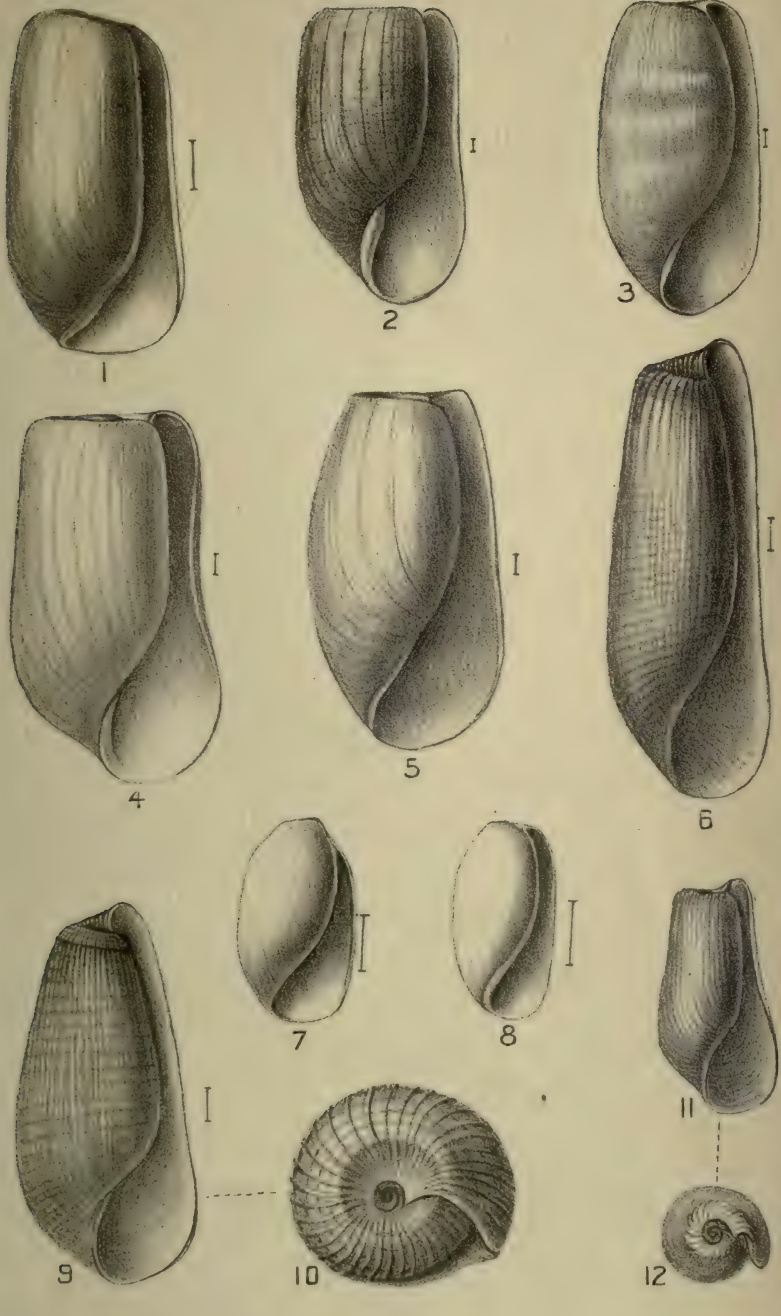
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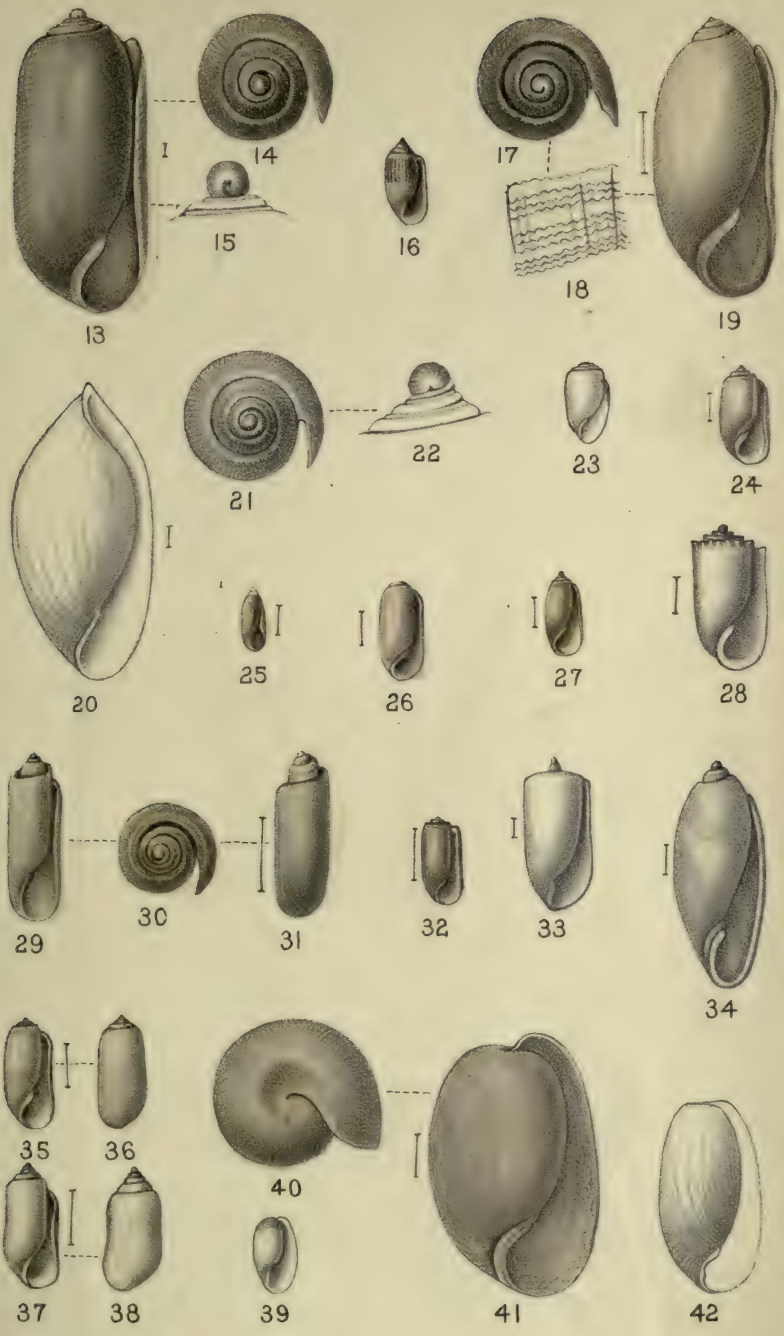
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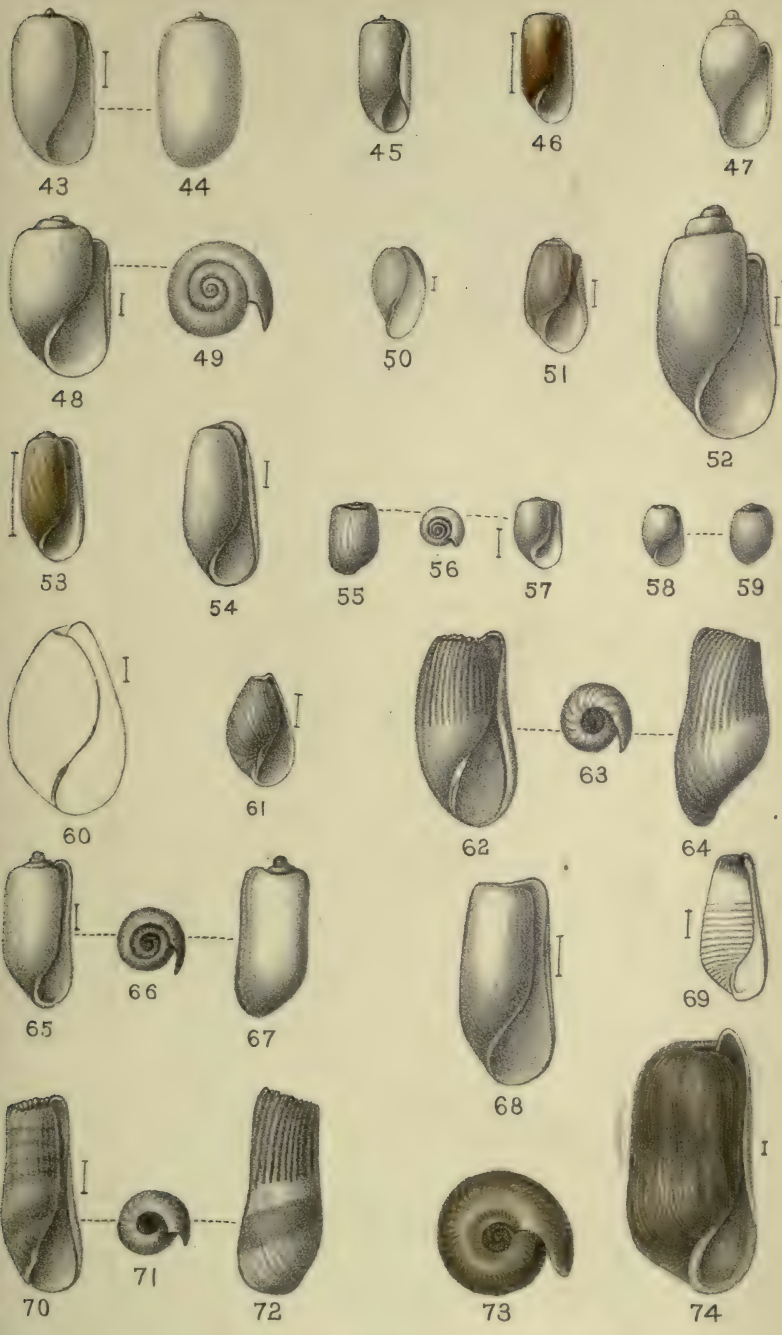
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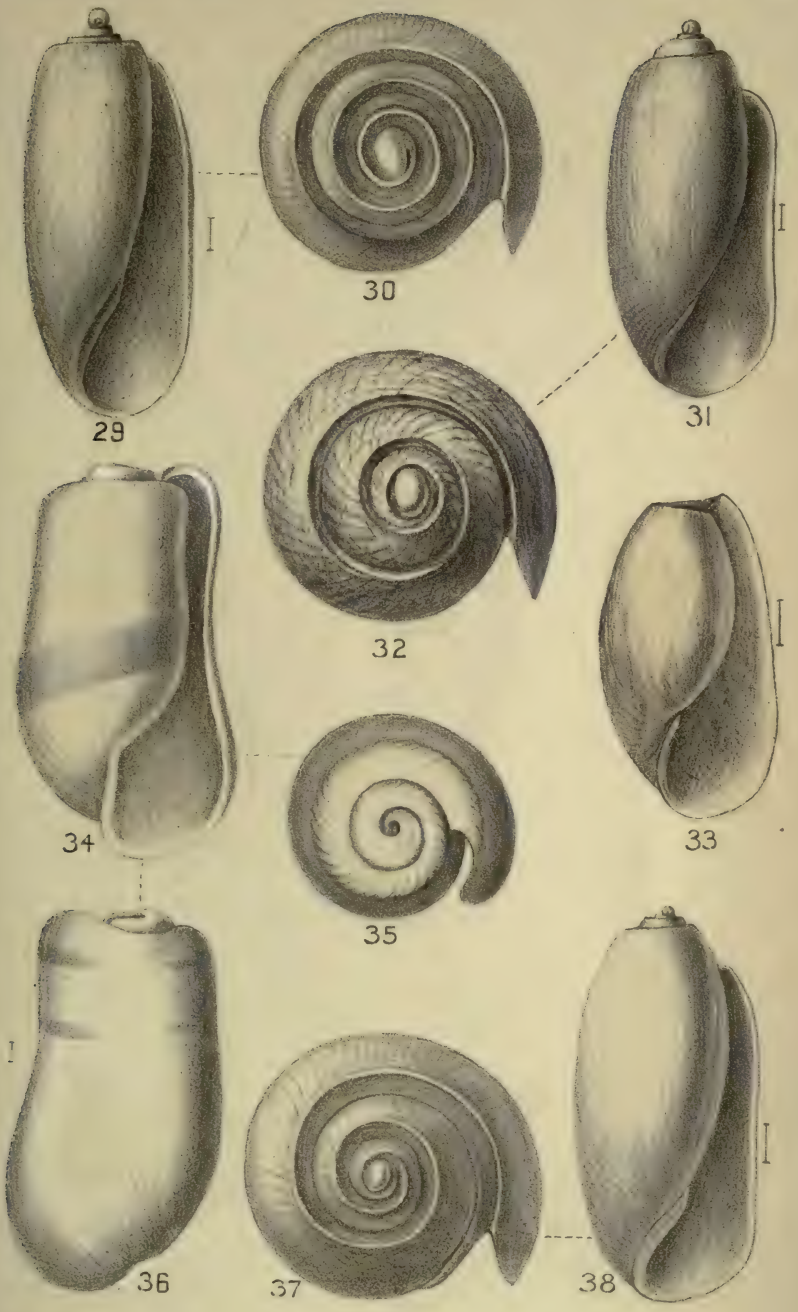
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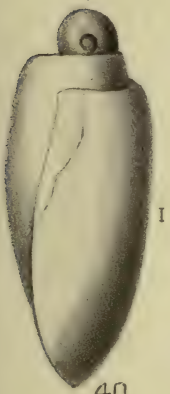
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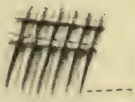
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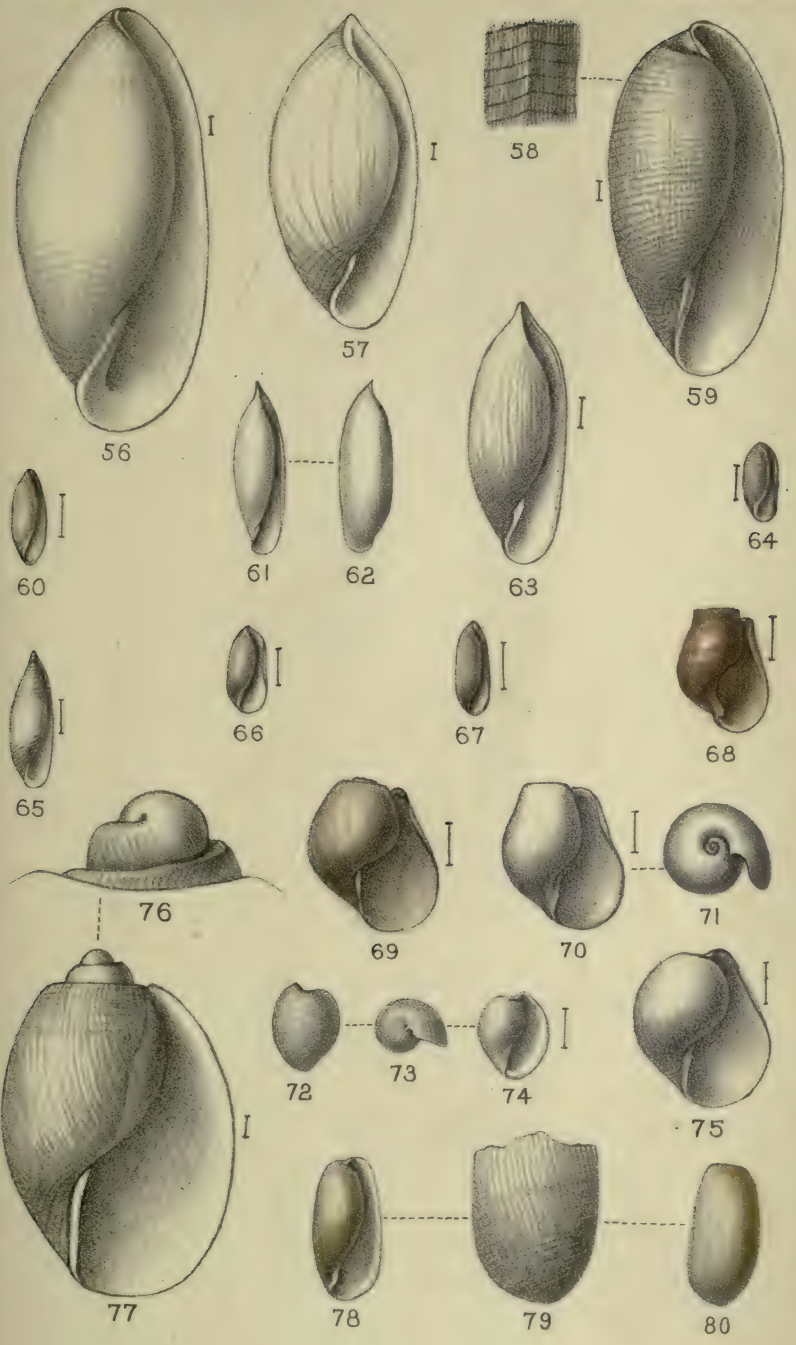
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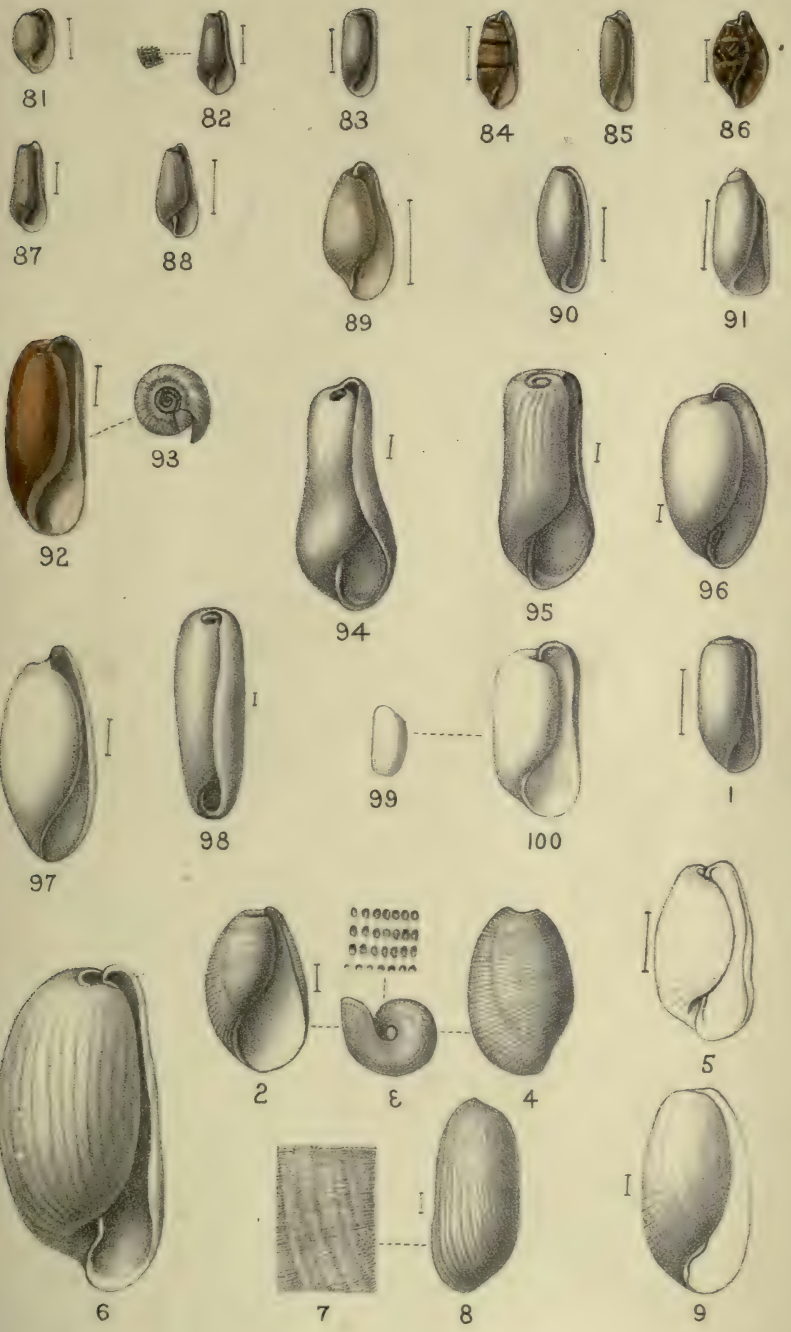
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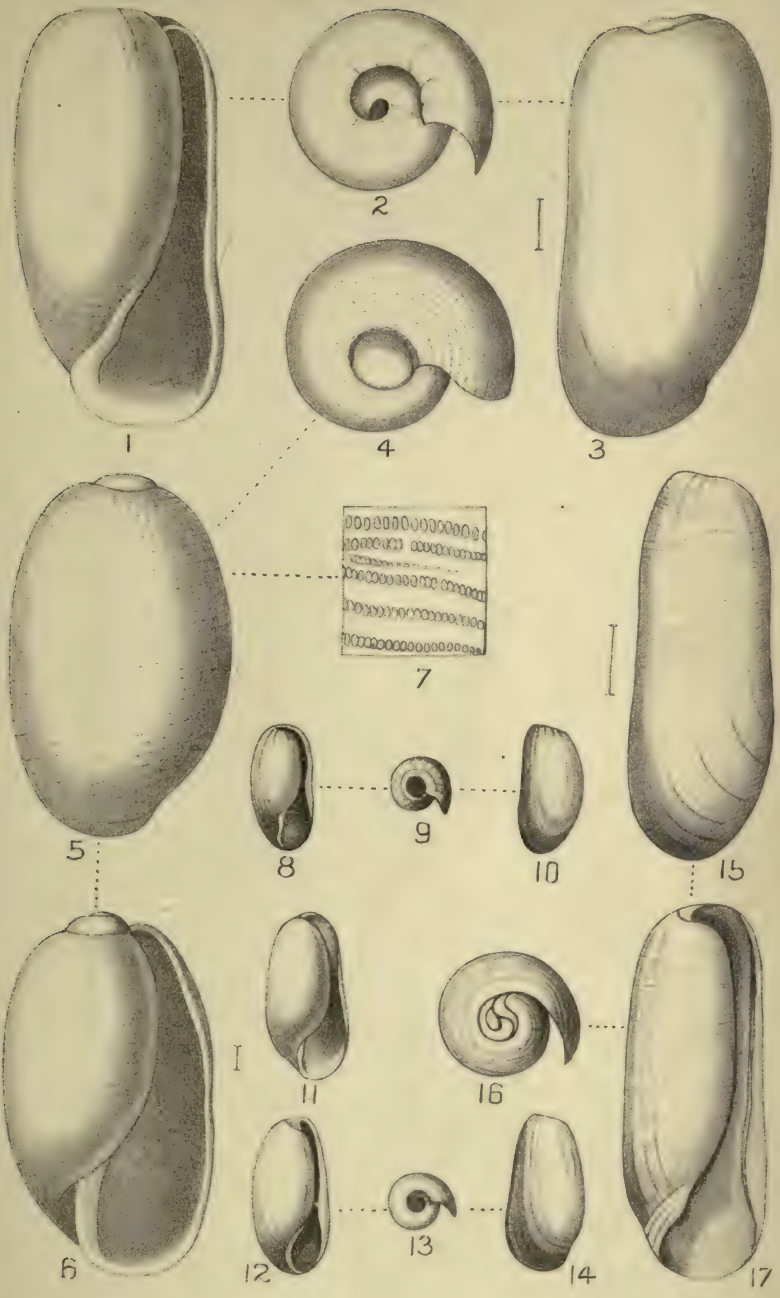
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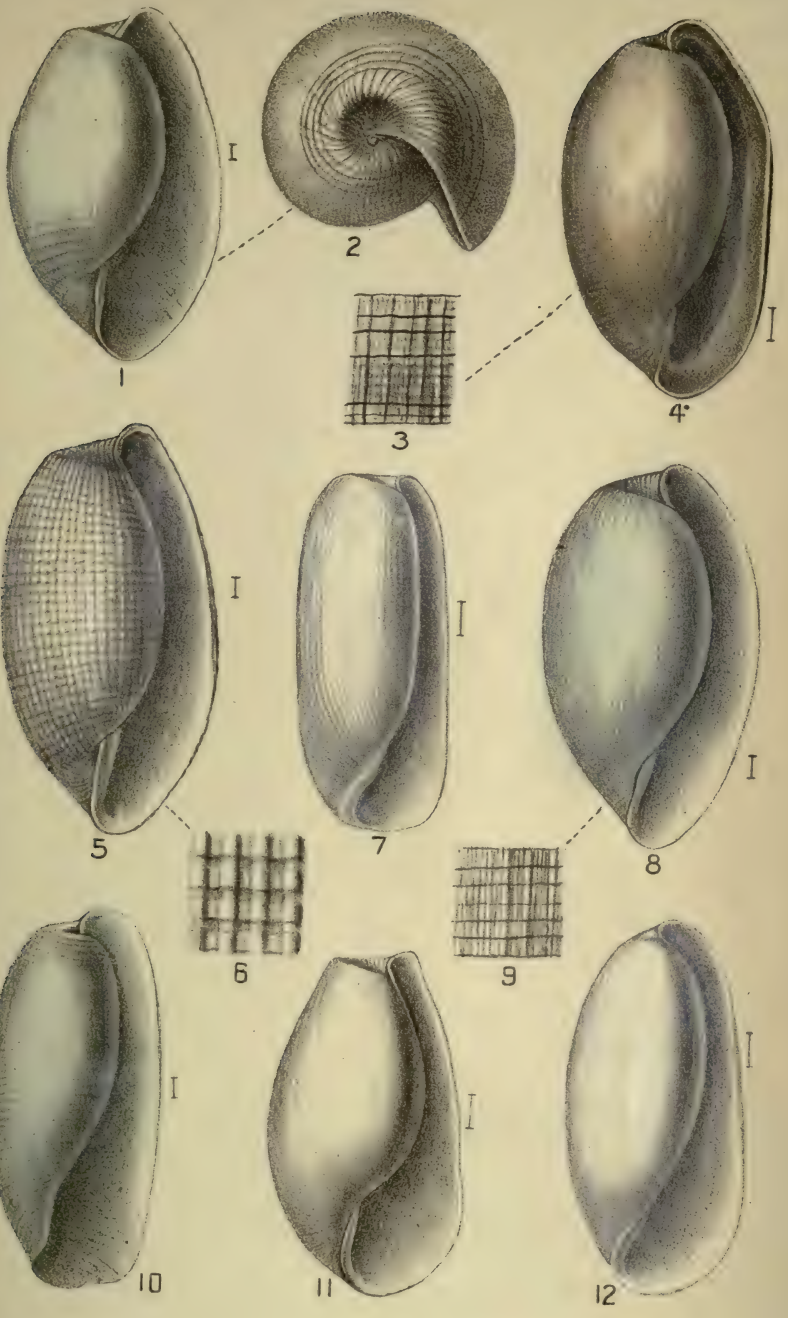
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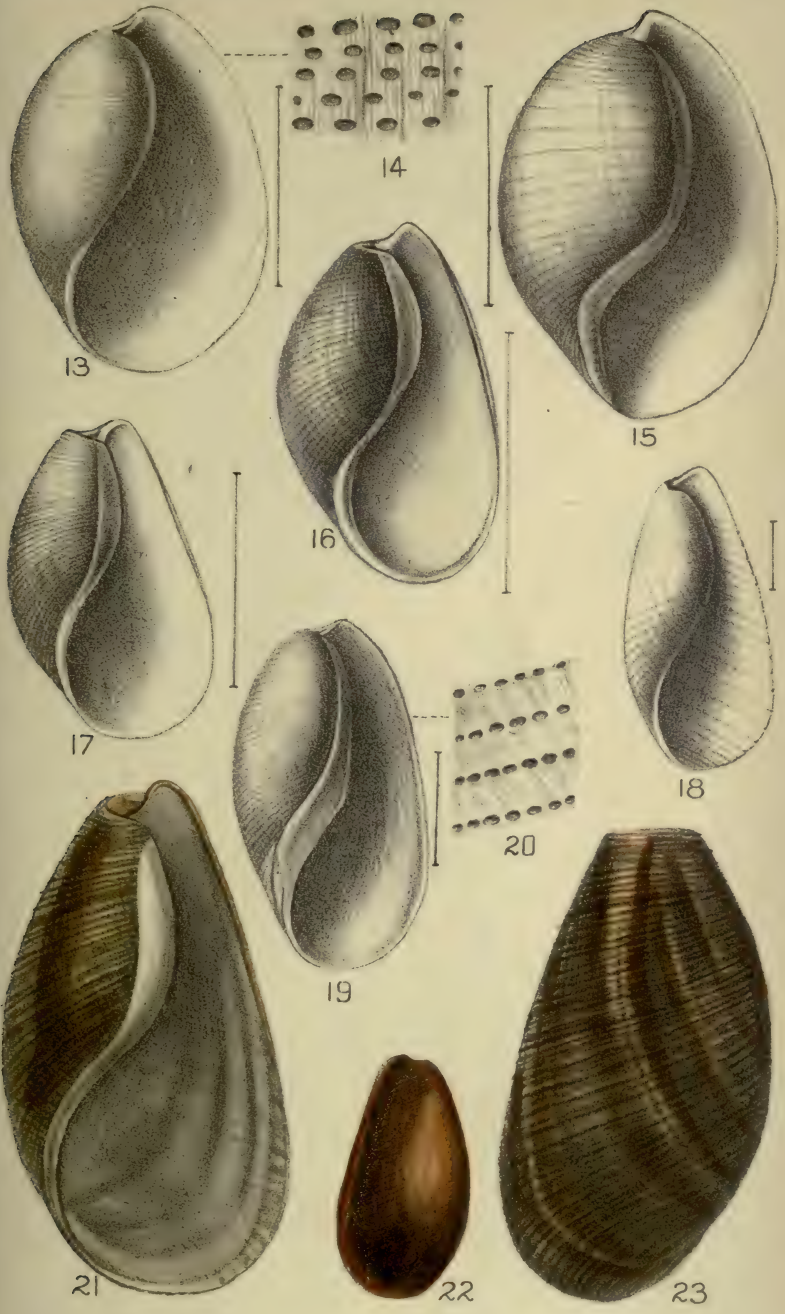
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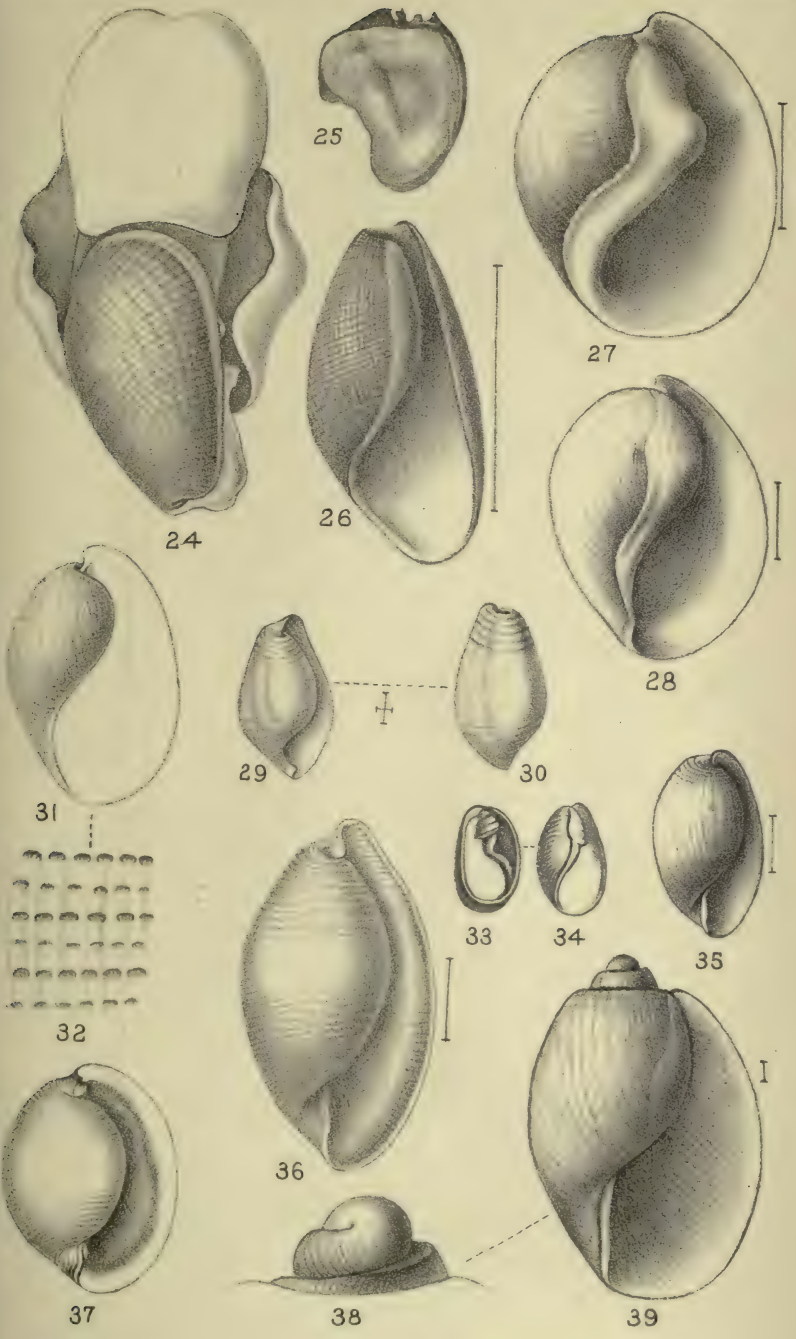
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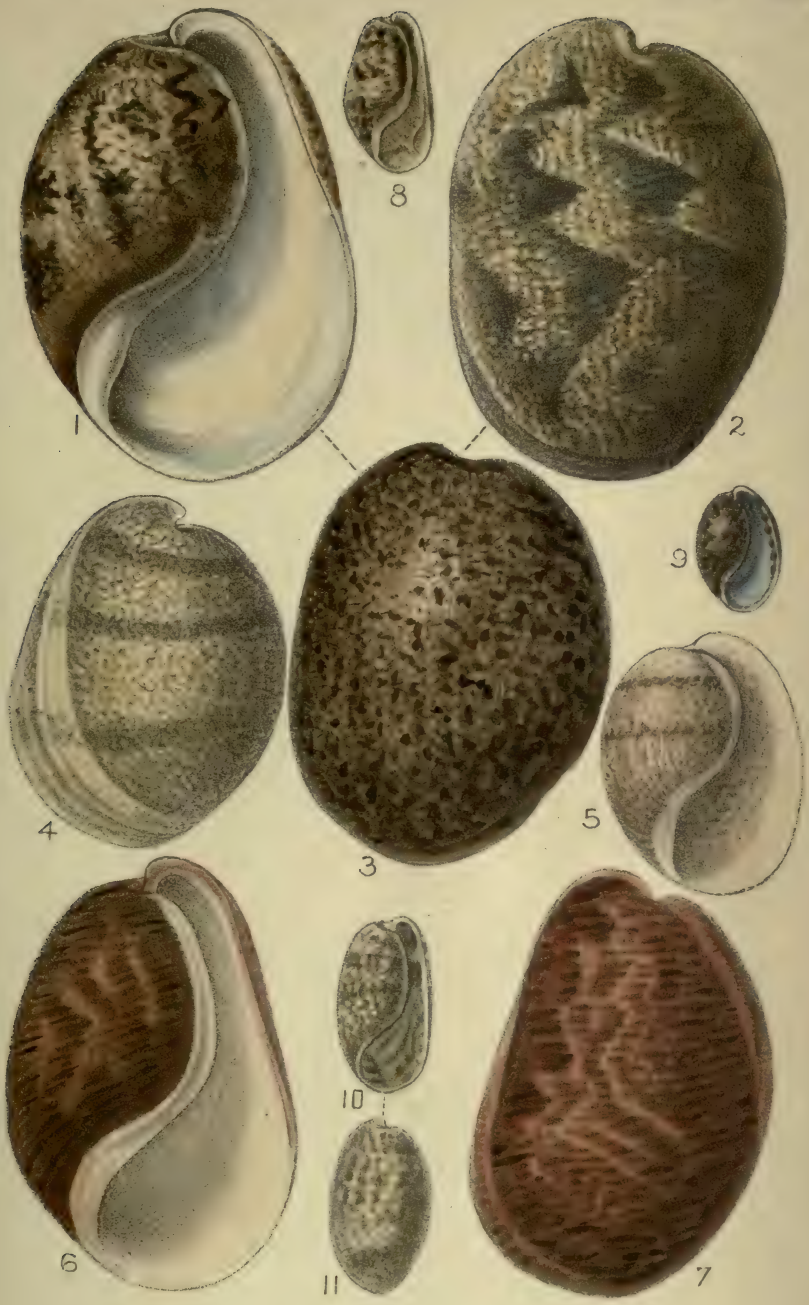
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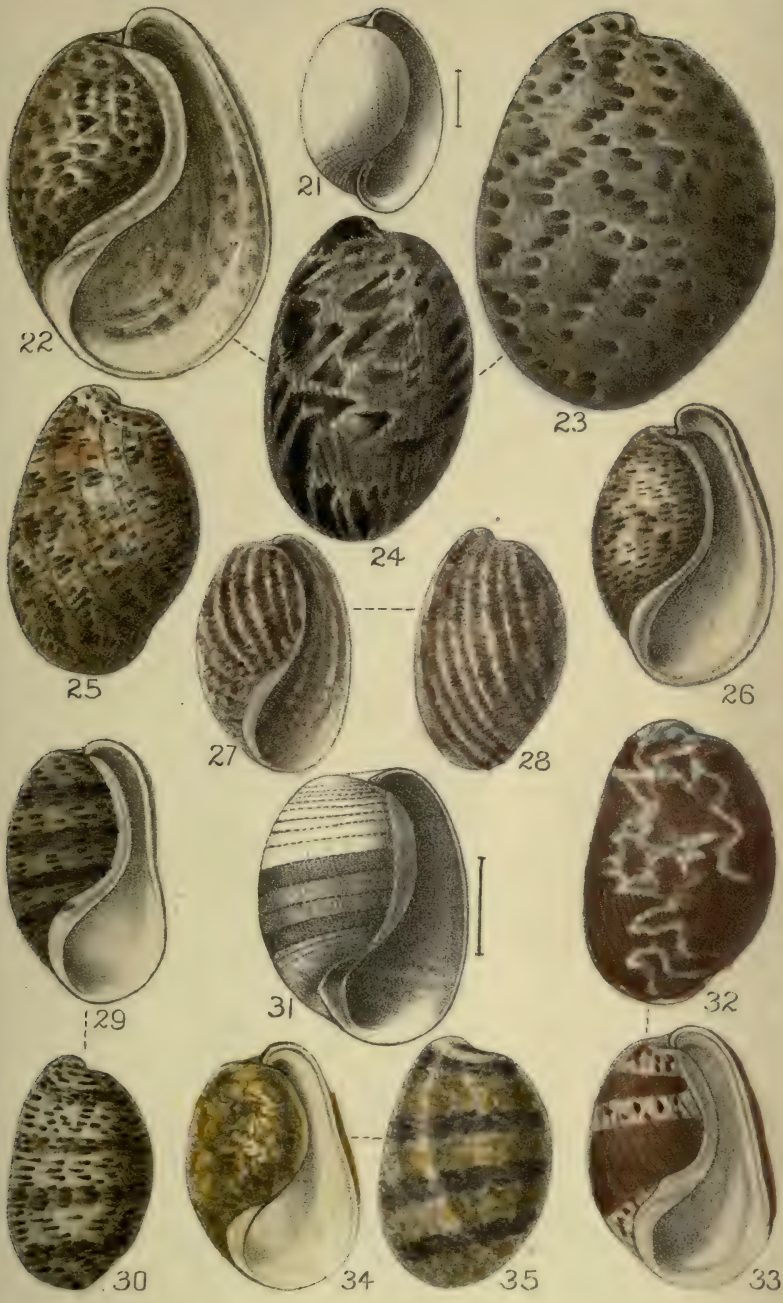
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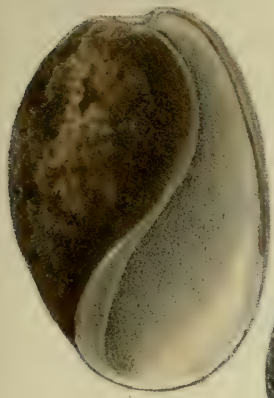
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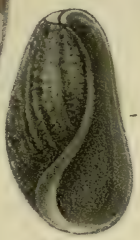
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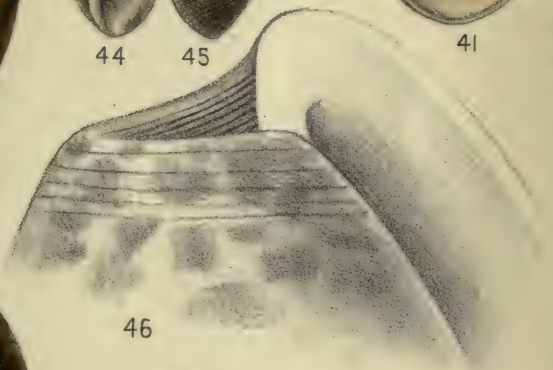
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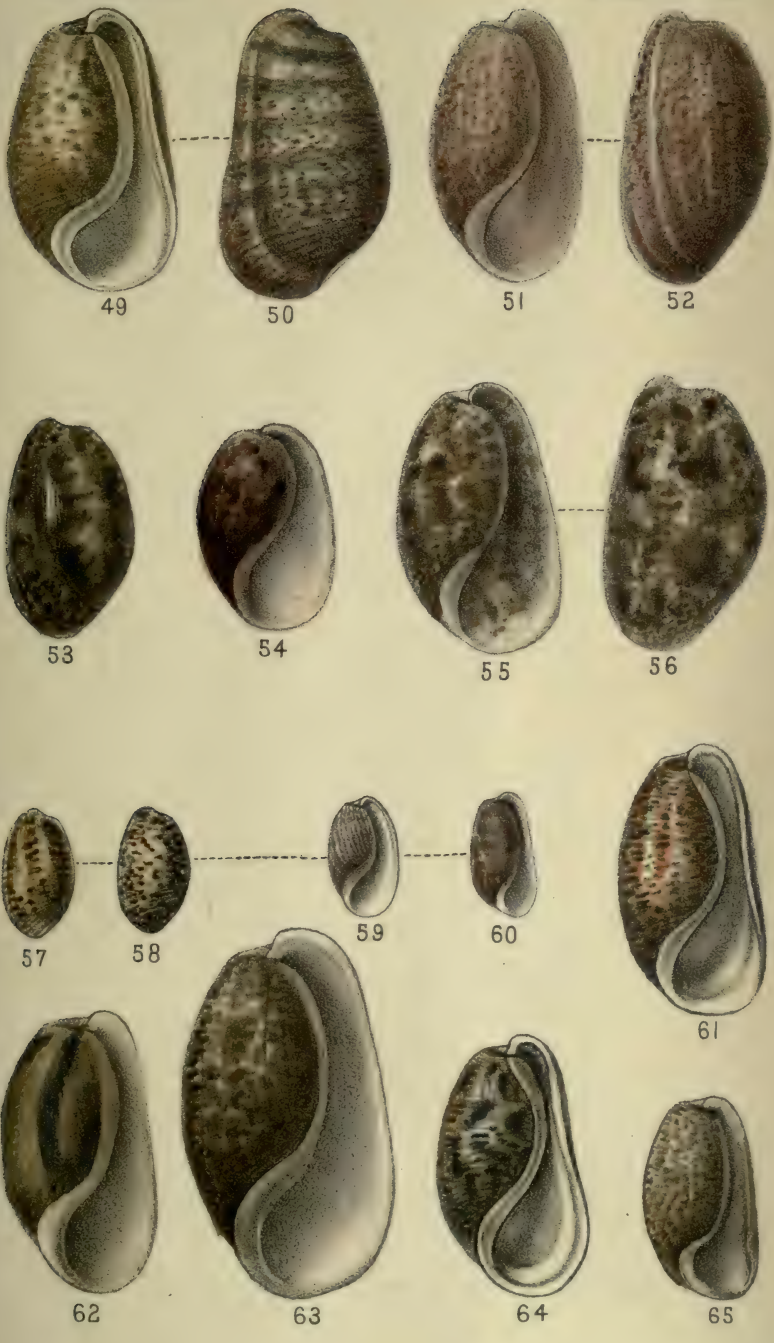
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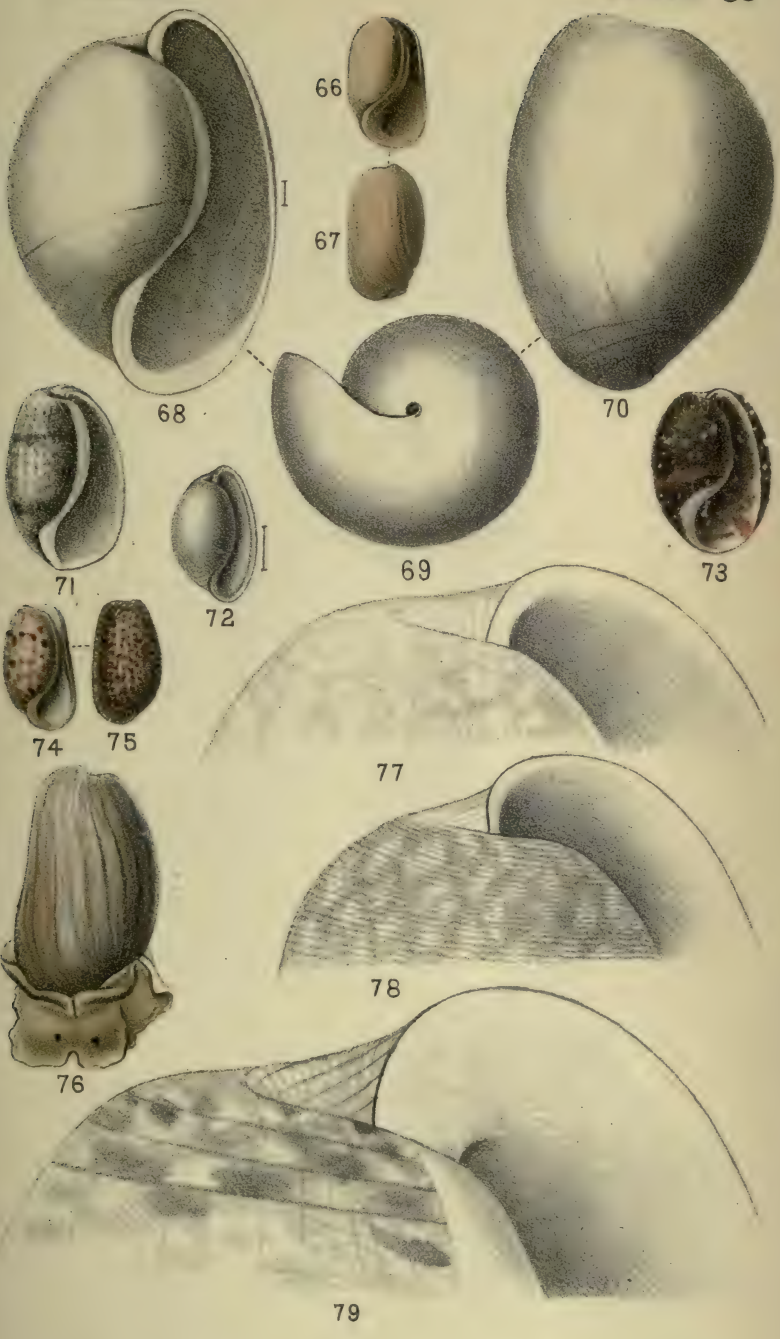
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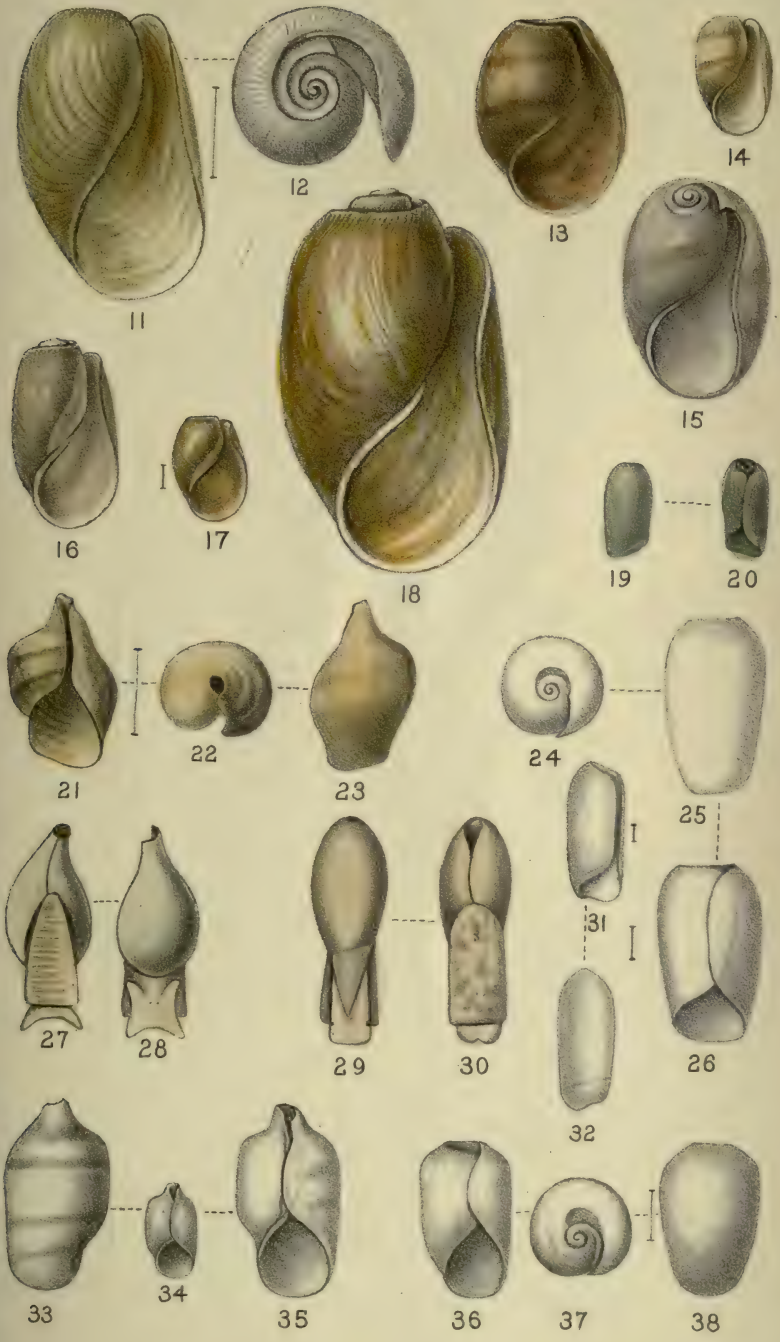
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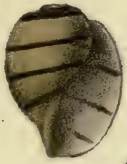
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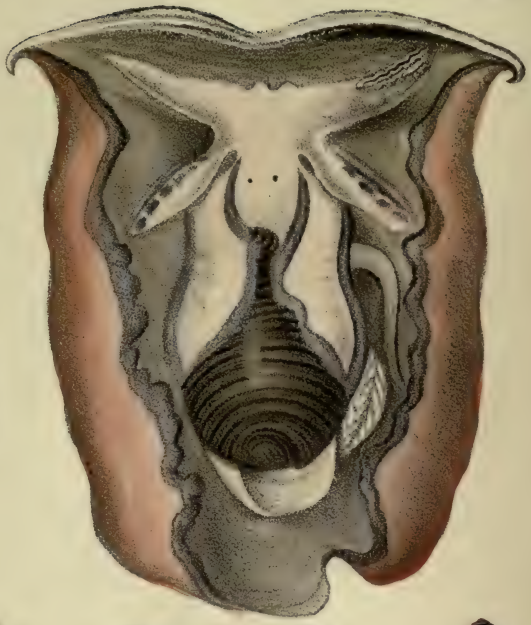
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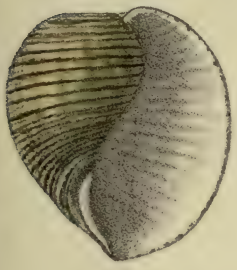
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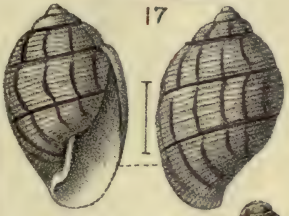
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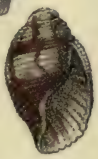
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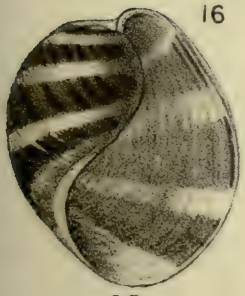
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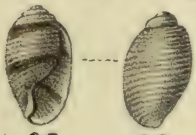
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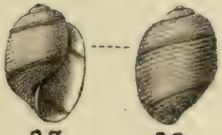
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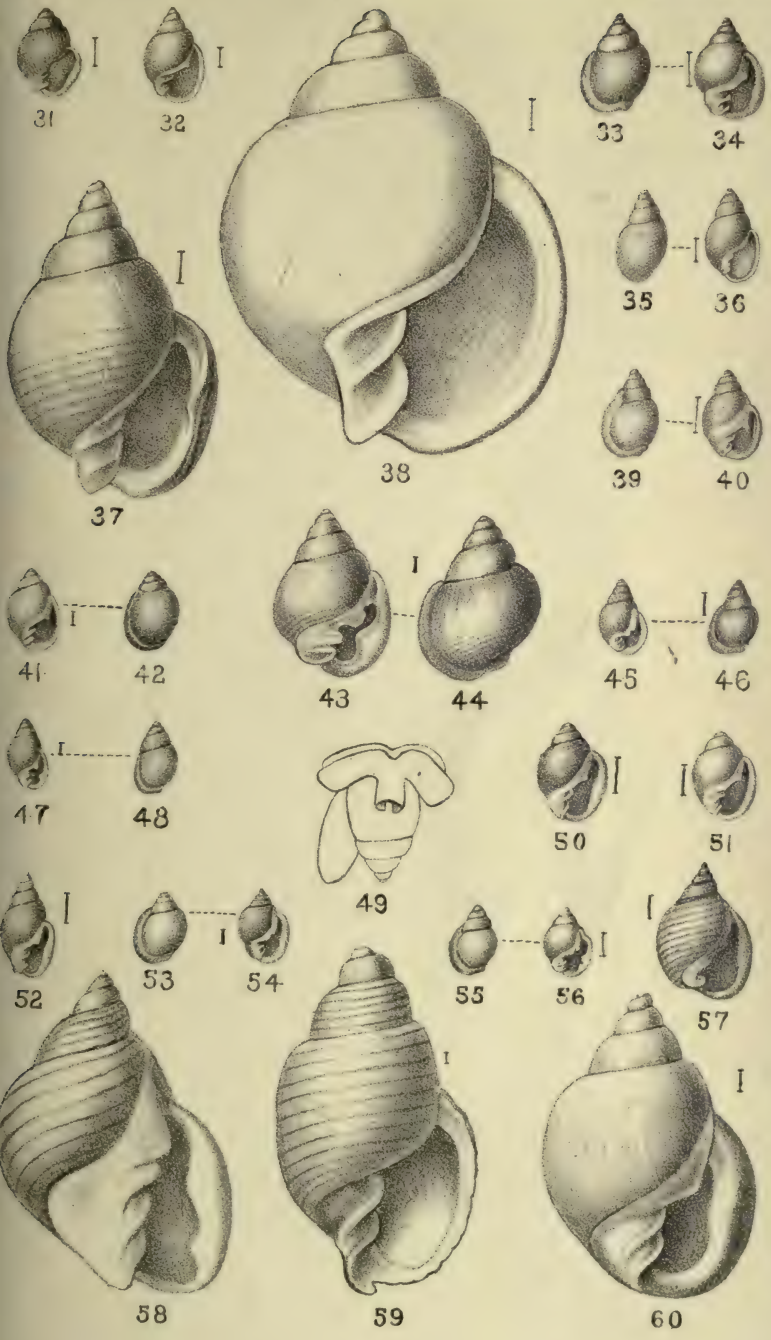
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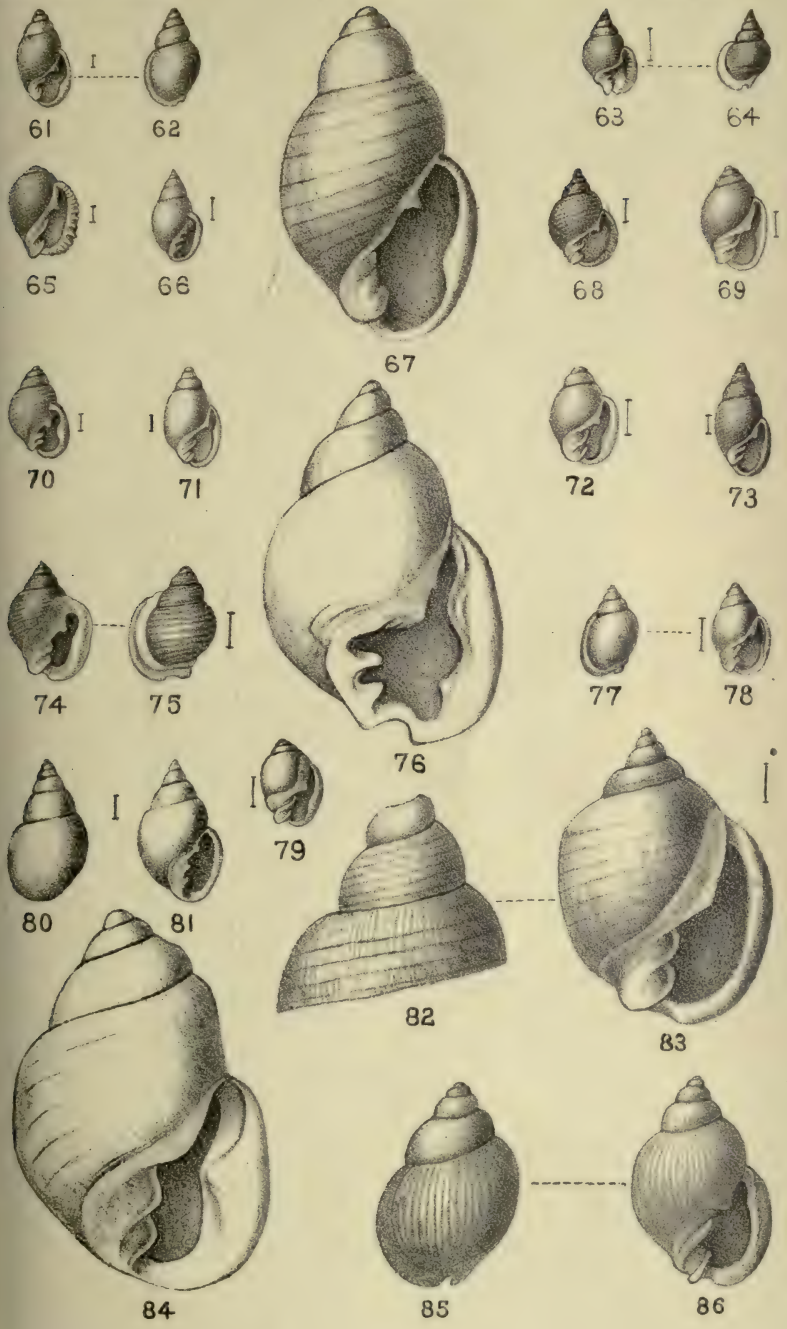
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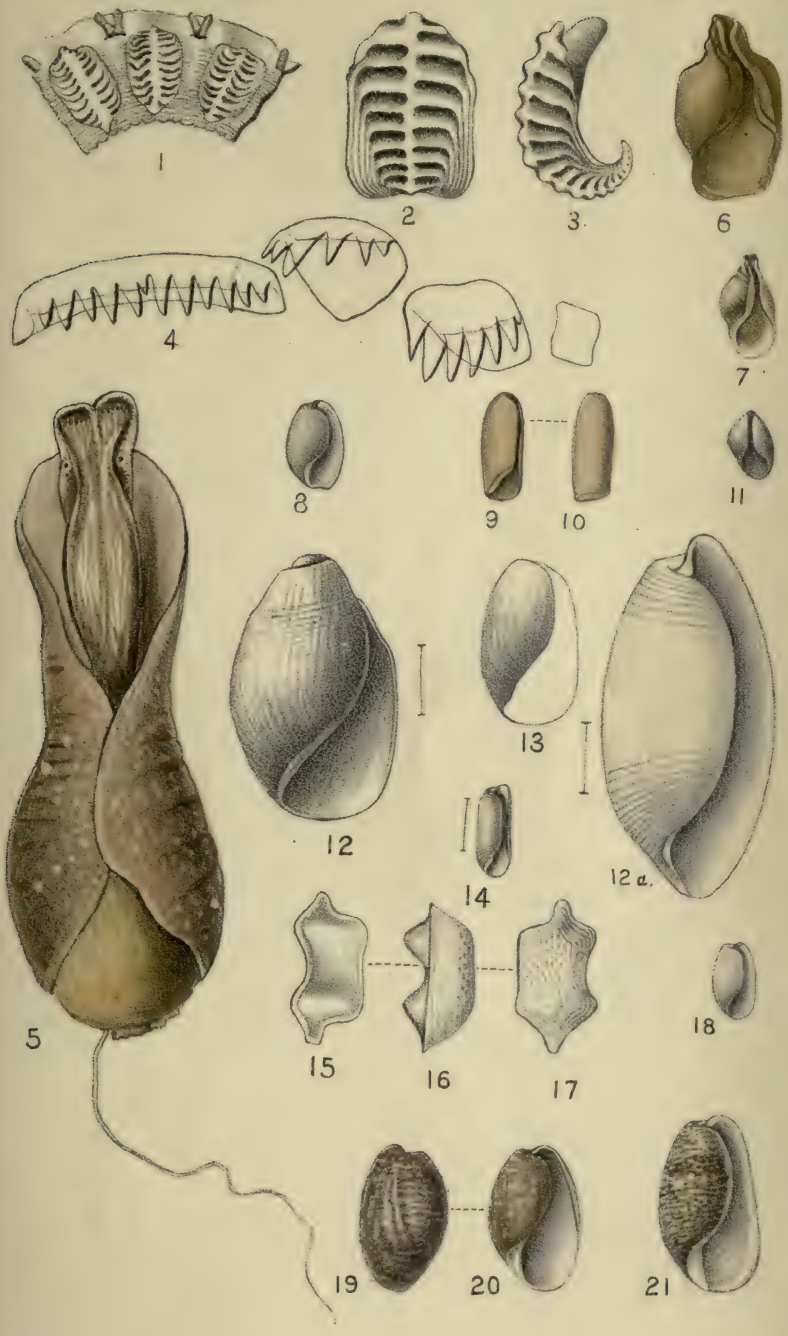
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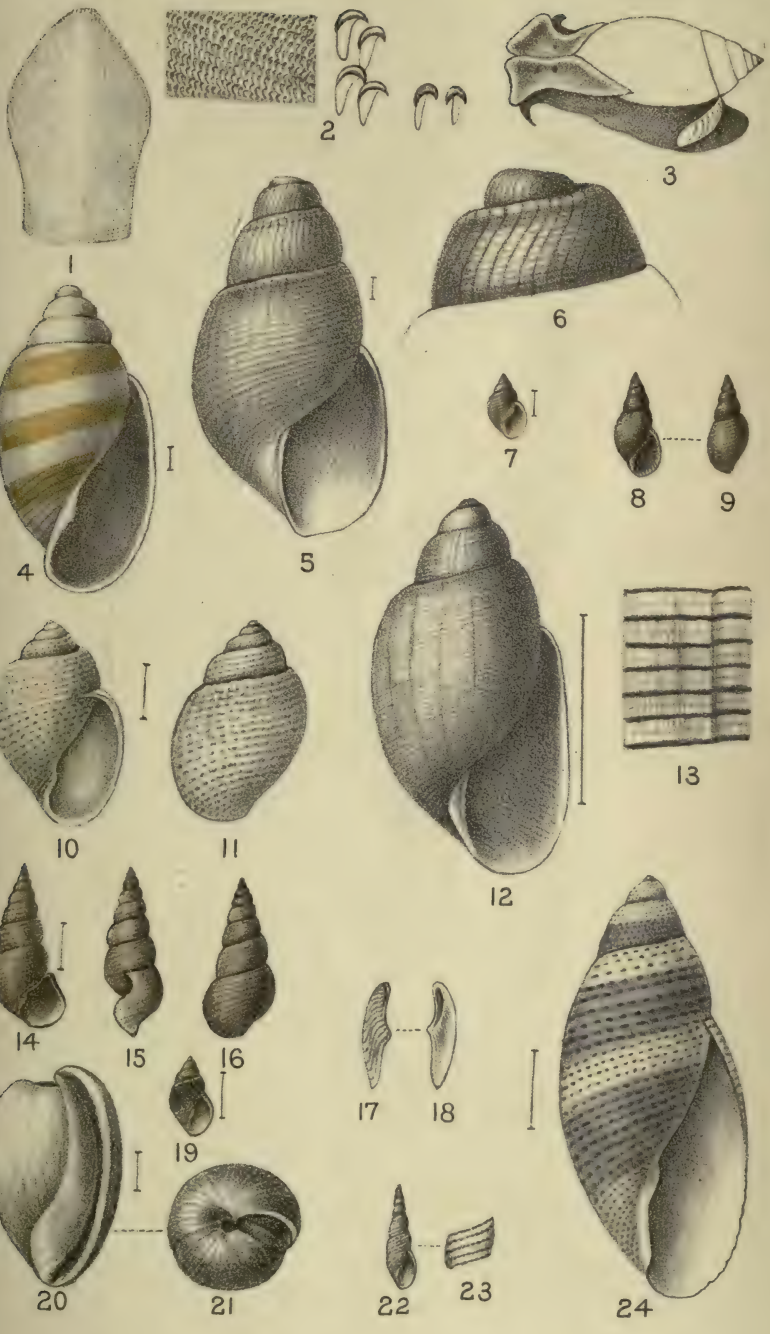
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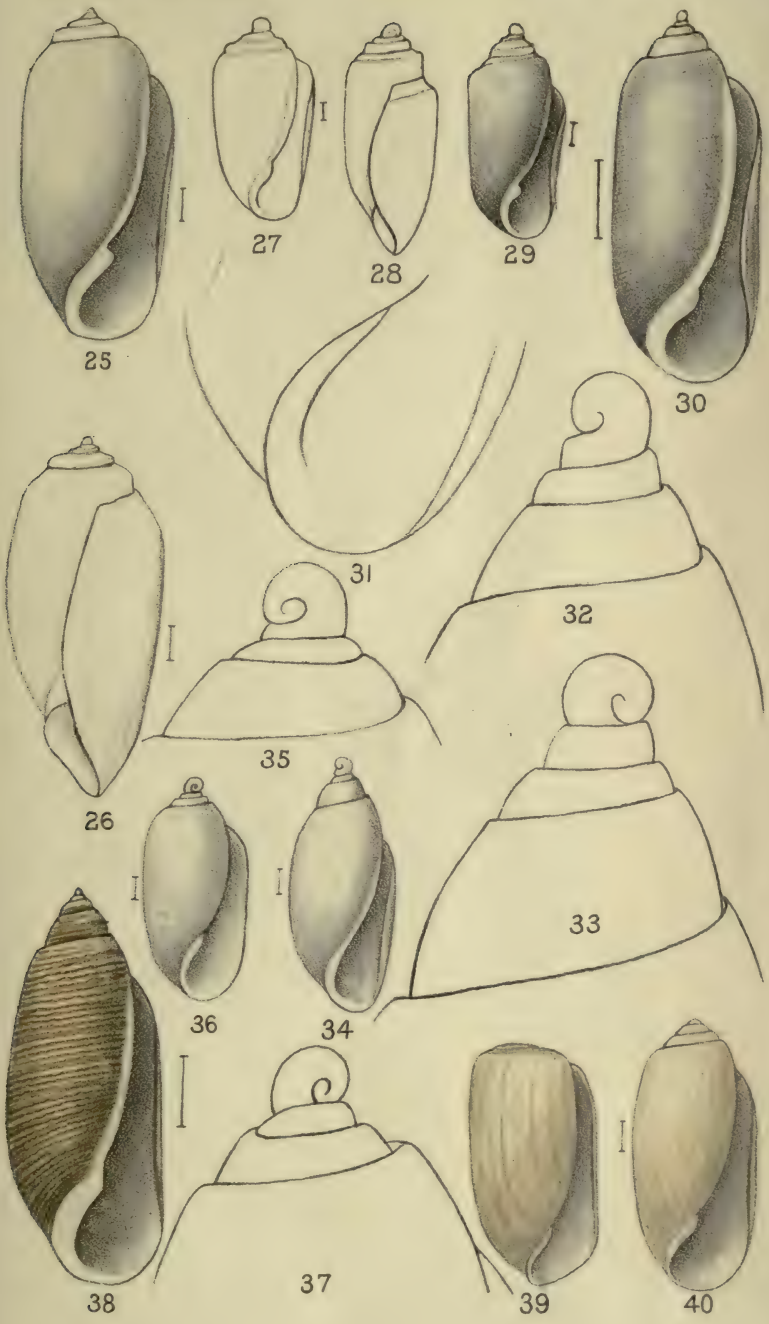
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NOTICE.

At the request of many subscribers, the Conchological Section has decided to issue one *Supplemental Volume* to the First Series, to include the internal or rudimentary-shelled Tectibranchs, *Philinidæ*, *Aplysiidæ*, etc., with the *Scaphopoda*, *Aplacophora*, and other matter not included in previous volumes. This volume will be sent to all subscribers unless otherwise ordered.

☞ By an error in numbering the plates, the numbers from 51 to 58 were omitted. See *Explanation of Plates* under PLATE 51. The references in the text are correct for the numbers as they now stand.

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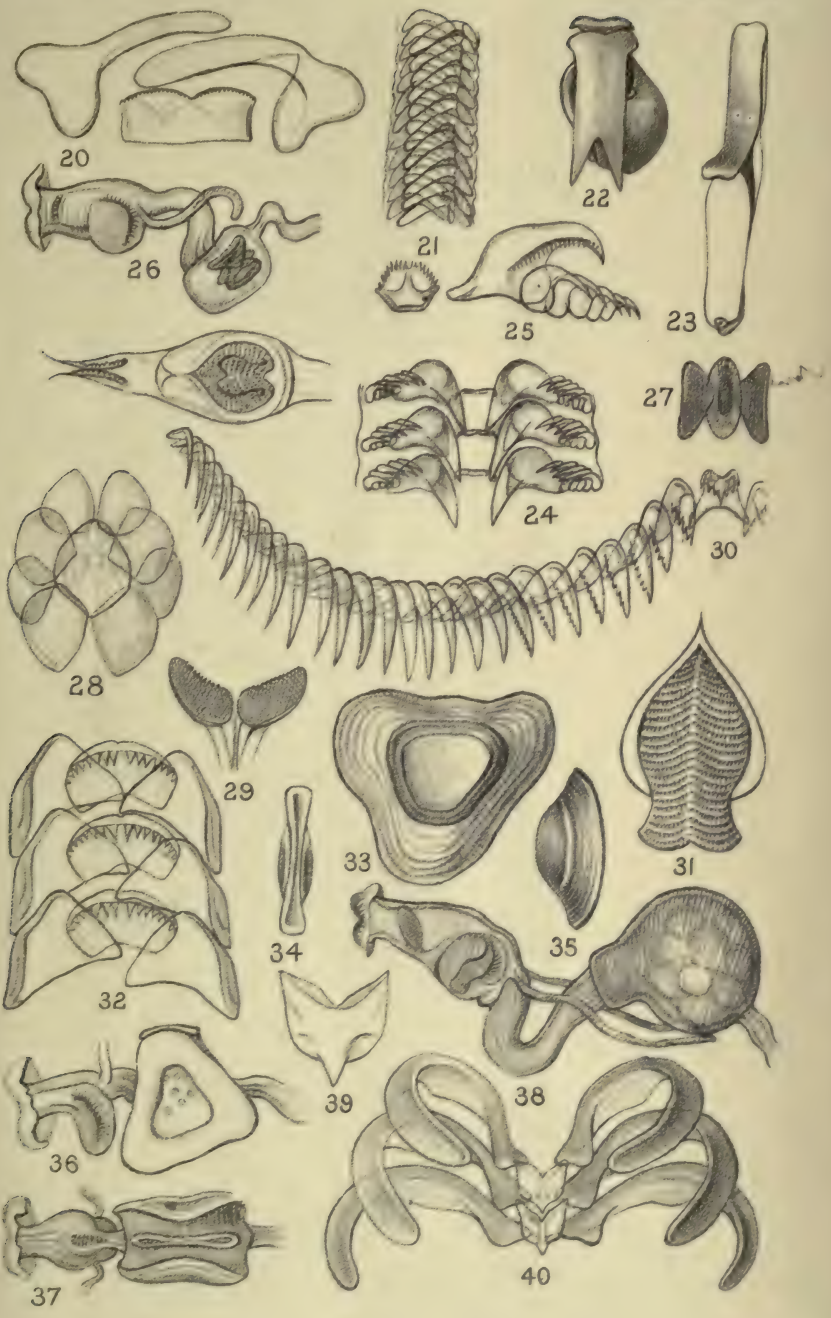
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